

AD-A095 634

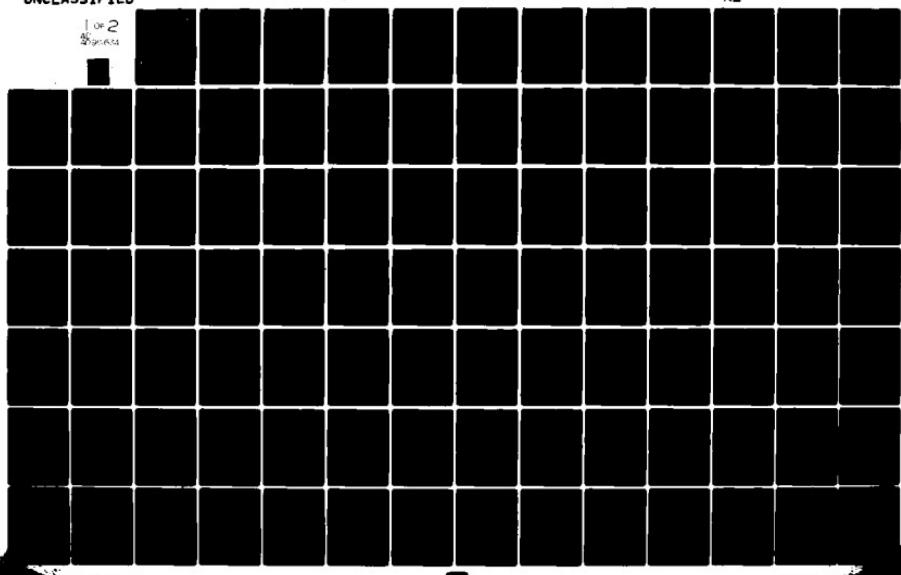
ROCKWELL INTERNATIONAL DALLAS TEX COLLINS RADIO GROUP  
STRESS ANALYSIS OF AIRCRAFT MODIFICATIONS (C-141B AIRCRAFT), JO--ETC(U)  
OCT 80 D B RAGAN

F/G 1/3  
F09603-80-C-0602

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UNCLASSIFIED

1 of 2  
29603



AD A 095634

REVIS.

| LTR | DESCRIPTION | DATE | APVD |
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**LEVEL**

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STRESS ANALYSIS  
OF  
AIRCRAFT MODIFICATIONS  
(C-141B AIRCRAFT).

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JOINT AIRBORNE COMMUNICATIONS CENTER/COMMAND POST  
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| 121 | 122 | 123 | 124 | 125 | 125 | 127 | Approved for public release,<br>Distribution Unlimited |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
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| 97  | 98  | 99  | 100 | 101 | 102 | 103 | 104  | 105 | 106 | 107 | 108 | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
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| 73  | 74  | 75  | 76  | 77  | 78  | 79  | 80   | 81  | 82  | 83  | 84  | 85  | 86  | 87  | 88  | 89  | 90  | 91  | 92  | 93  | 94  | 95  | 96  |
| -   | -   | -   | -   | -   | -   | -   | -  | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   |     |
| 49  | 50  | 51  | 52  | 53  | 54  | 55  | 56   | 57  | 58  | 59  | 60  | 61  | 62  | 63  | 64  | 65  | 66  | 67  | 68  | 69  | 70  | 71  | 72  |
| -   | -   | -   | -   | -   | -   | -   | -  | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   | -   |     |
| 25  | 26  | 27  | 28  | 29  | 30  | 31  | 32   | 33  | 34  | 35  | 36  | 37  | 38  | 39  | 40  | 41  | 42  | 43  | 44  | 45  | 46  | 47  | 48  |

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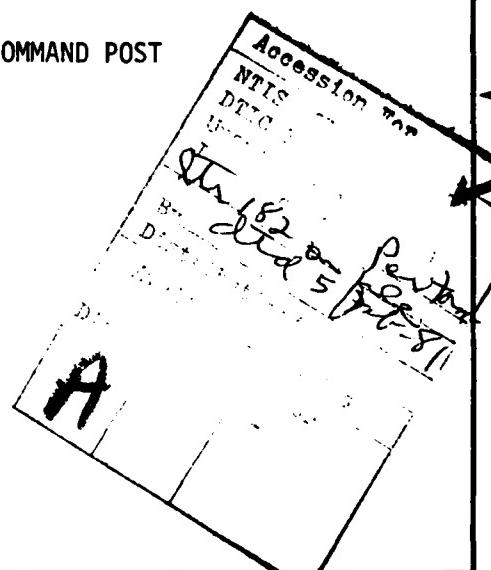
REL  REV\_ \_ TC\_ \_ CR\_ \_ NB\_ \_ DL\_ \_

## REVISIONS

| LTR | DESCRIPTION | DATE | APVD |
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STRESS ANALYSIS  
OF  
AIRCRAFT MODIFICATIONS  
(C-141B AIRCRAFT)

JOINT AIRBORNE COMMUNICATIONS CENTER/COMMAND POST  
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|                          |       |   |   |   |   |   |   |   |   |   |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |
|--------------------------|-------|---|---|---|---|---|---|---|---|---|------------|--------------|----|----|----|----|----|----|----|----|----|----|----|----|----|
| REV STATUS               | REV   |   |   |   |   |   |   |   |   |   |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |
| OF SHEETS                | SHEET | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9   | 10         | 11           | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| CONTRACT NO.             |       |   |   |   |   |   |   |   |   | ROCKWELL INTERNATIONAL CORPORATION<br>COLLINS RADIO GROUP           |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |
| F09603-80-C-0602         |       |   |   |   |   |   |   |   |   | DALLAS, TEX 75207 NEWPORT BEACH, CALIF 92663 CEDAR RAPIDS, IA 52406 |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |
| PREP D.B. RAGAN 10-24-80 |       |   |   |   |   |   |   |   |   | STRESS ANALYSIS C-141B AIRCRAFT<br>JACC/CP PROGRAM                  |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CHK                      |       |   |   |   |   |   |   |   |   |   |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |
| APVD                     |       |   |   |   |   |   |   |   |   |   |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                          |       |   |   |   |   |   |   |   |   | SIZE  | CODE IDENT | DWG NO.      |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                          |       |   |   |   |   |   |   |   |   | A   | 13499      | 649-2924-001 |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                          |       |   |   |   |   |   |   |   |   | SCALE   |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                          |       |   |   |   |   |   |   |   |   | SHEET 1 OF 127  |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |
|                          |       |   |   |   |   |   |   |   |   | METRIC  |            |              |    |    |    |    |    |    |    |    |    |    |    |    |    |

REL  REV \_\_\_\_ TC \_\_\_\_ CR \_\_\_\_ NB \_\_\_\_ DL \_\_\_\_ TU \_\_\_\_

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|                  |                            |                                |
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| SCALE            | REV                        | SHEET 2                        |

SUMMARY

Stress Analyses were performed on the following aircraft modifications:

- AT1108 Antenna Installation,
- HF Longwire Installation,
- UPS-192 Antenna Installation,
- 437S-1C Antenna Installation, and
- SATCOM Antenna Installation .

The detailed conclusions of each of the topics above are contained after each sub-analysis. However, the general conclusion is that each of the subject modifications in no way impare the airworthiness of the aircraft in that the aircraft strength is equal to or greater than the original unmodified strength.

P 4

|                  |                            |                                |
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| SCALE            | REV                        | SHEET 3                        |

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REFERENCES

1. T.O. 1C-141A-3
2. MIL HDBK 5C
3. Formulas For Stress and Strain, 5th Edition, Roark & Young
4. Analysis and Design of Flight Vehicle Structures, 2nd Edition, E.F. Bruhn

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
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| SCALE            | REV                        | SHEET 4                        |

1.0 AT 1108 UHF / VHF / AM ANTENNA INSTALLATION  
Dwg. No. 649-2883-001

The antenna is mounted on top of the fuselage at F.S. 1267, LBL 6.40. The modification consist of a rectangular plate, 5.12 x 12.25 x .093 thk, attached to the original skin and a 7.29 x 6.90 x .080 thk doubler. The new rivets are NAS 1097D4. There are two .750 Dia. holes in the doubler and filler plate.

Reference Drawings :      649-2883      Installation  
                                649-2880      Filler  
                                649-2879      Doubler

(a) Strength of original skin structure

Skin : 7075 T6 Clad .056 thk (Ref 1)

Critical Shear buckling stress of panel

$$a = 20.0 \quad \} \quad a/b = 3.33 \\ b = 6 \quad \}$$

K ≈ 8.5 (Ref 3 table 35 manner 4 b)

$$\begin{aligned} S_{cr} &= K \frac{E}{1 - \mu^2} \left( \frac{t}{b} \right)^2 \\ &= 8.5 \frac{(10.3 \times 10^6)}{.89} \left( \frac{.056}{6} \right)^2 = 8559 \text{ psi} \end{aligned}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
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| SCALE            | REV                        | SHEET 5                 |

Critical shear flow in panel

$$\begin{aligned}q_{cr} &= S_{cr} \cdot t \\&= 8559 (.056) = 479 \text{ lb/in}\end{aligned}$$

(b) strength of filler plate : 2024 T3 .093 thk.

$$\left. \begin{array}{l} a = 12.25 \\ b = 5.12 \end{array} \right\} \quad a/b = 2.39$$

$$K \approx 9.5$$

$$S_{cr} = 9.5 \left( \frac{10.5 \times 10^6}{.89} \right) \left( \frac{.093}{5.12} \right)^2 = 36,978 \text{ psi}$$

Critical Shear Flow

$$q_{cr} = 36,978 (.093) = 3439 \text{ lb/in}$$

Strength of doubler : 2024 T3 .080 thk.

$$\left. \begin{array}{l} a = 7.29 \\ b = 6.90 \end{array} \right\} \quad a/b = 1.05$$

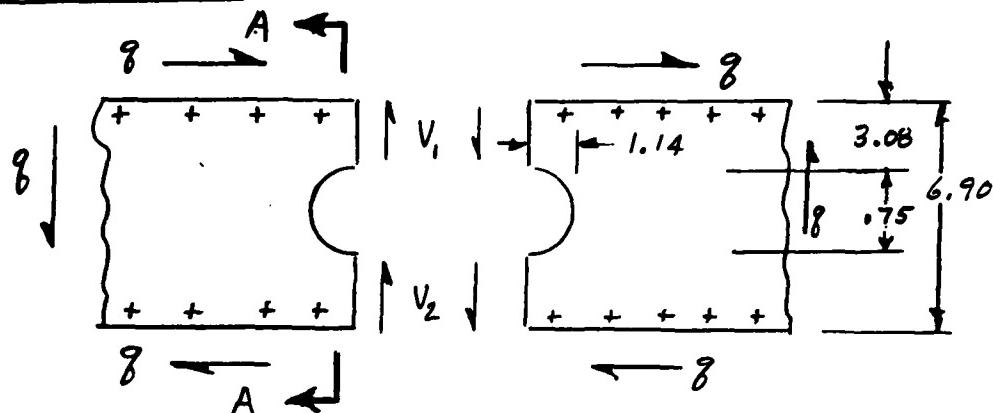
$$K \approx 12.7$$

$$S_{cr} = 12.7 \left( \frac{10.5 \times 10^6}{.89} \right) \left( \frac{.080}{6.9} \right)^2 = 20,141 \text{ psi}$$

$$q_{cr} = 20,141 (.08) = 1611 \text{ lb/in}$$

|                  |                            |                         |
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(C) Circular CUTOUT



Assume area between holes ineffective

$$V_1 = V_2 = \frac{1}{2} 8 (6.90) = 3.45 8$$

$$I_1 = I_2 = \frac{.229 (3.08)^3}{12} = .558 \text{ in}^4$$

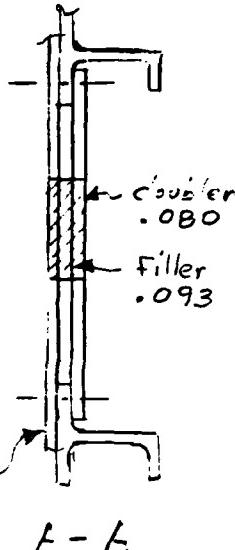
$$\text{MoM } M_1 = 3.45 (479)(1.14) = 1884 \text{ in-lb}$$

This moment is greater than actual when considering the area between the two holes will actually resist bending.

Maximum Bending Stress

$$\sigma_B = \frac{1884 (3.08)}{.558} = 10,399 \text{ psi}$$

SKIN  
0.056



$$\sigma_{allow} = 64 \text{ ksi } 2024 \text{ T3} \quad (\text{Ref 2})$$

$$\text{M.S.} = \frac{64000}{10,399} - 1 = - - - + 5.19$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
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| SCALE            | REV                        | SHEET<br>7              |

(d) CONSIDER PURE TENSION LOAD IN SKIN

Load lost by cutout in skin

$$72000 \text{ psi} (.75)(.056) = 3024 \text{ lbs}$$

Using filler as load carrying member

$$2024 \text{ T3 } F_{tu} = 62 \text{ ksi } F_{bnu} = 125 \text{ ksi } \text{ (Ref 2)}$$

$$\sigma = \frac{3024}{(5.12 - .75)(.093)} = 7441 \text{ psi}$$

M.S. +

Use NAS 1097D4 rivets to transfer load. Ultimate Shear Strength = 443 lbs, yield strength = 251 lbs

$$\text{Rivets required} = \frac{3024}{251} = 12$$

Rivets installed = 23

$$\text{MS} = \frac{23}{12} - 1 - - - - + .92$$

(e) Summary

The analysis shows that sufficient strength to carry all induced loads has been designed into the modification with the following Margins of Safety

$$\text{M.S. (Tensile ult.)} = 5.19$$

$$\text{M.S. (Rivet attachment)} = .92$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
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| SCALE            | REV                        | SHEET 8                 |

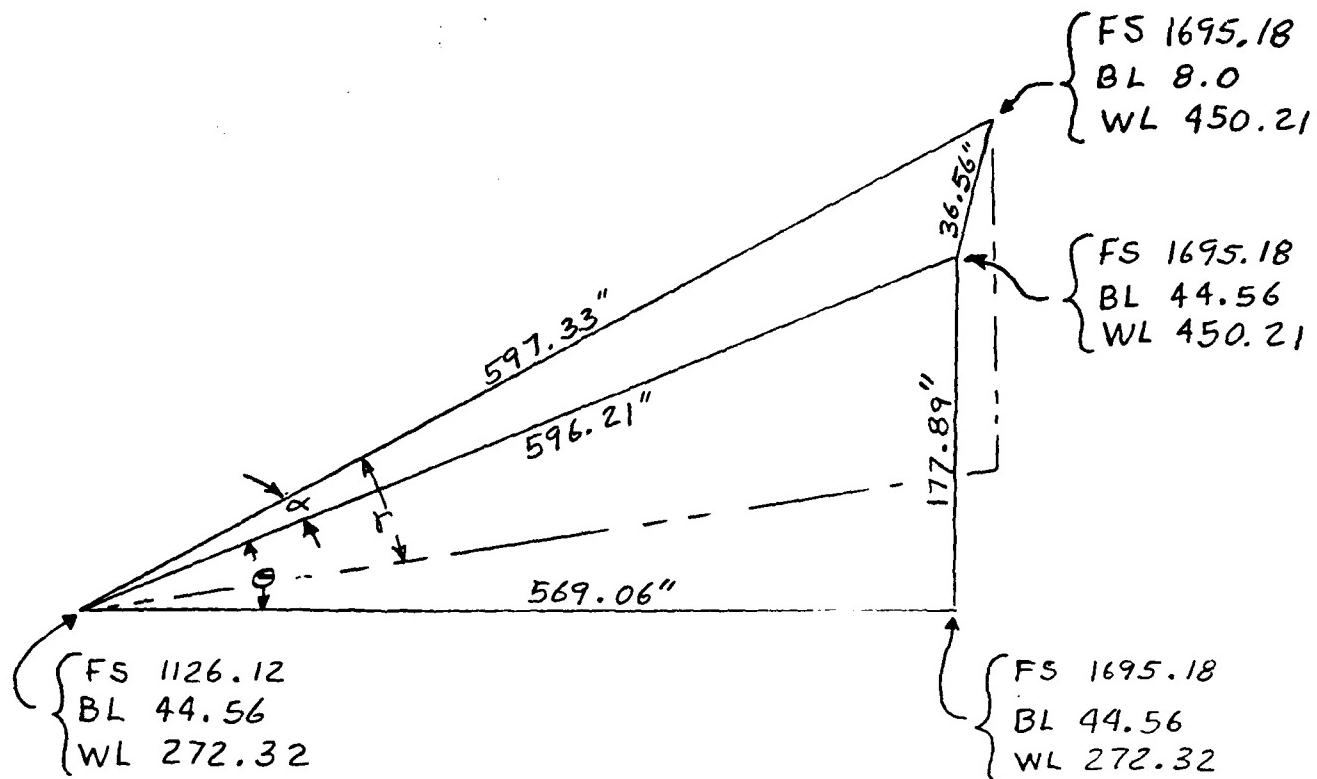
## 2.0 H.F. LONGWIRE INSTALLATION

Two H.F. longwire antennas are mounted on the  
upperside of the aircraft at F.S. 1126, L&RBL  
44.56, W.L. 272 and connected to the tail  
structure (tail lifting point) at FS 1695,  
L&RBL 8.0 WL 450

Reference Drawings: '649-2824 Installation

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
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| SCALE            | REV                        | SHEET 9                        |

a) Geometry of installation



$$\theta = \sin^{-1} \frac{177.89}{596.21} = 17.36^\circ$$

$$\alpha = \sin^{-1} \frac{36.56}{597.33} = 3.51^\circ$$

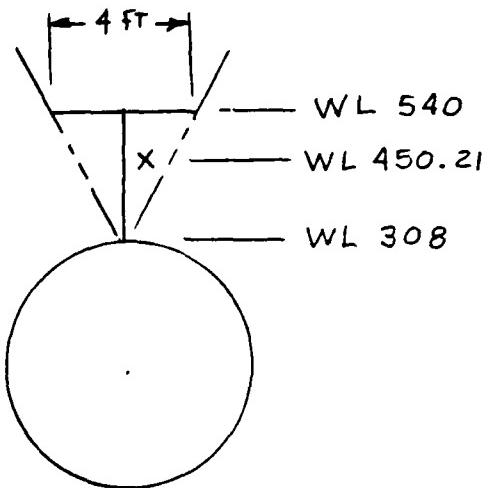
$$\gamma = \sin^{-1} \frac{177.89}{597.33} = 17.33^\circ$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
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| SCALE            | REV                        | SHEET 10                |

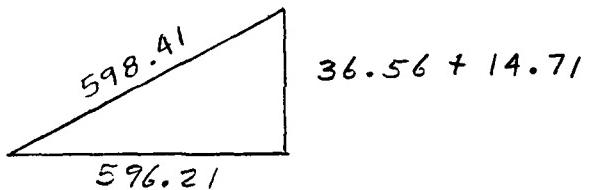
## Vertical stabilizer lateral movement

$$X = \frac{24(142.21)}{232}$$

$$X = 14.71 \text{ inches}$$



## Extension of antenna length



Tension takeup must move  $598.41 - 597.33 = 1.08$  inches

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
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| SCALE            | REV                        | SHEET 11                |

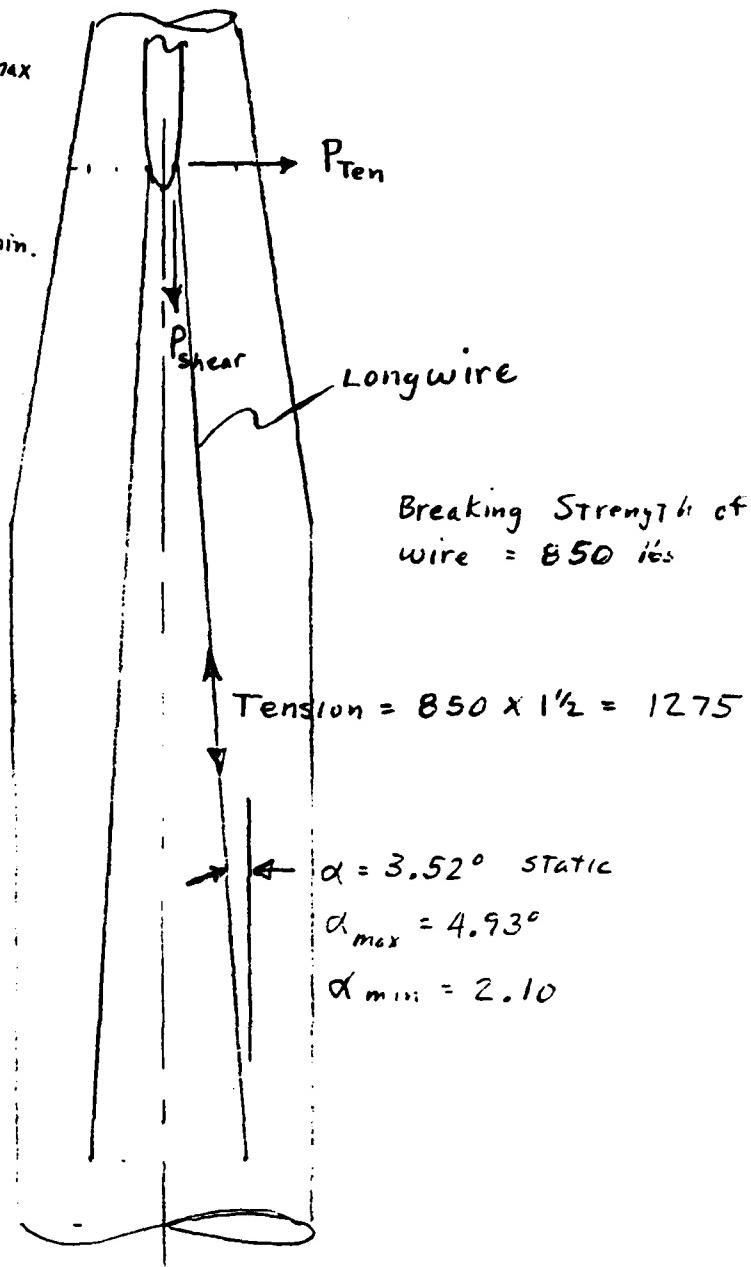
## Load on tail fitting

$$P_{Ten, max} = \text{Tension} \times \sin \alpha_{max}$$

$$= 109.57 \text{ lbs}$$

$$P_{shear max} = \text{Tension} \times \cos \alpha_{min.}$$

$$= 1274 \text{ lbs}$$



Plan View

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
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| SCALE            | REV                        | SHEET 12                |

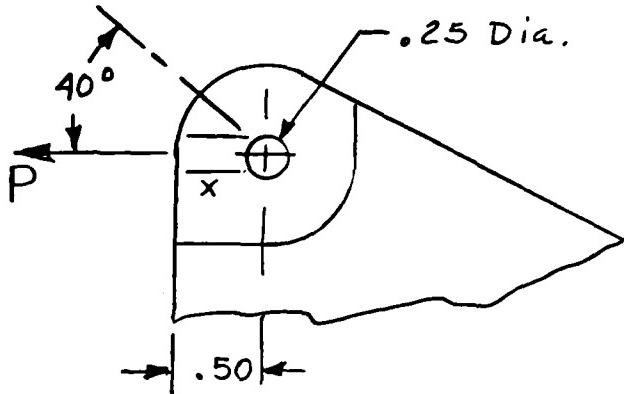
b) Tail Fitting P/N 649-2801

Mat'L. 2024-T351 QQ-A-25014

$$F_{tu} = 62,000 \text{ psi} \quad (\text{Ref 2})$$

$$F_{su} = 37,000 \text{ psi}$$

$$F_{bru} = 115,000 \text{ psi} \quad (e/D=2)$$



Bearing

Bearing Factor 2.0  
Fitting Factor 1.15

$$f_{bru} = \frac{1275}{.10(.25)} = 51000 \text{ psi}$$

$$\text{M.S.} = \frac{115000}{51000(2)} - 1 = \underline{\underline{\underline{\underline{\quad}}}} + .13$$

Shear tearout

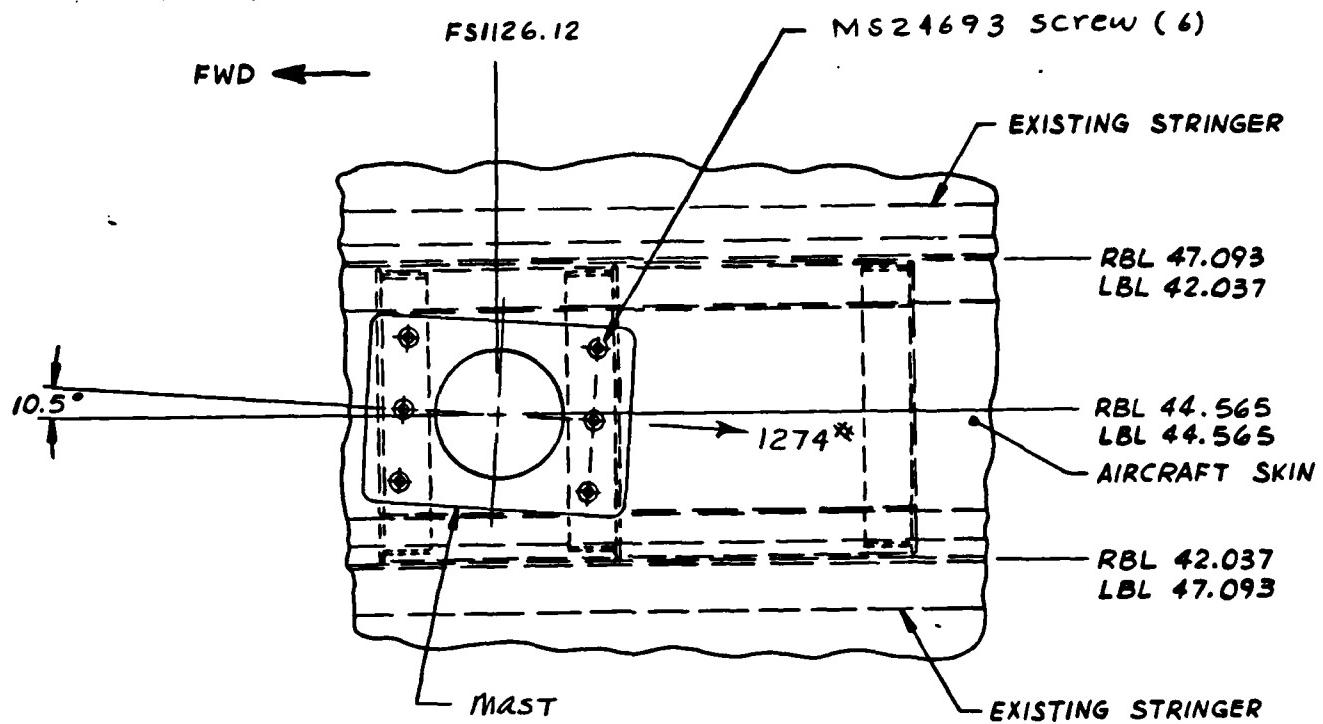
$$f_s = \frac{1275}{2(.10)(.50 - .25 \cos 40^\circ)} = 20665 \text{ psi}$$

$$\text{M.S.} = \frac{37000}{20665(1.15)} - 1 = \underline{\underline{\underline{\underline{\quad}}}} + .56$$

The fitting is secured to the tail structure with 4 - NAS 517-4 bolts 160,000 psi minimum U.T.S.  
the Longwire is secured to the fitting by one AN4 bolt. Single shear strength of 368 lbs.

|                  |                            |                         |
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C) Antenna Mast installation P/N 15186 C.I. 83044



A 2.50 inch diameter hole is cut in the aircraft skin for the mast installation.

Skin : 7075-T6 clad .056 thk (Ref 1)

$F_{tu} = 72000 \text{ psi}$  (Ref 2)

Load capability lost

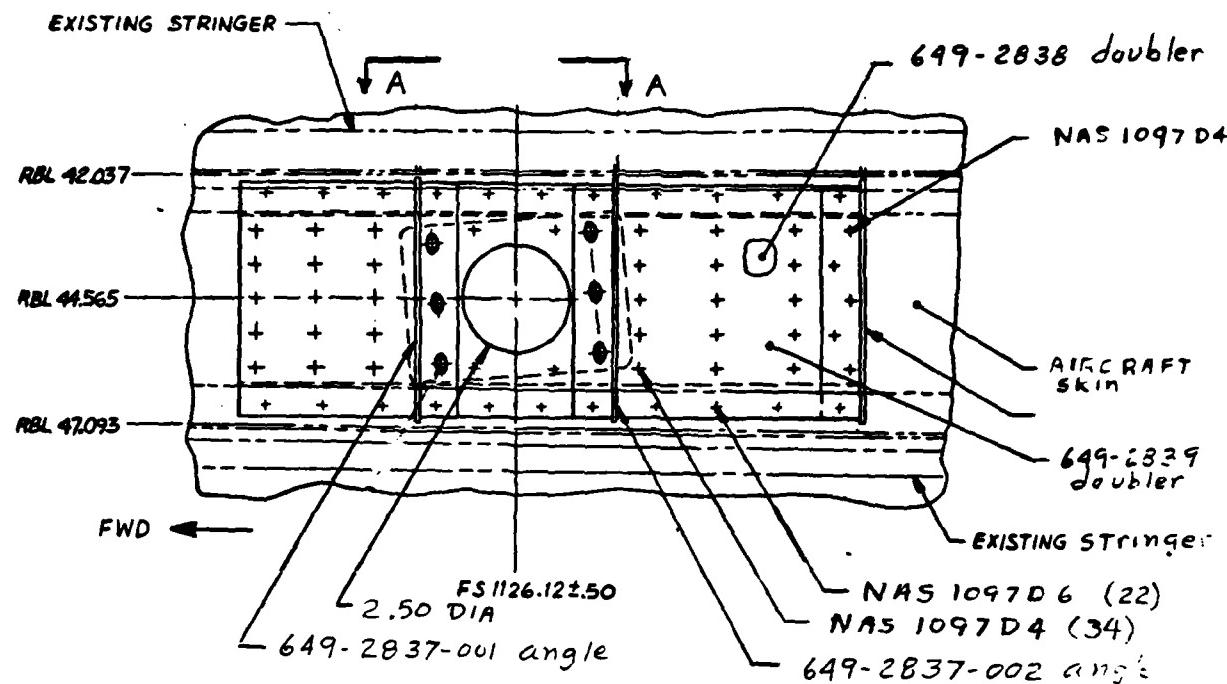
$$P = 2.5 (.056)(72000) = 10,080 \text{ lbs.}$$

Two doublers are used to carry load thru plus distribute the 1274 lb Longwire load' into the skin and stringers.

Ref. drawings 649-2838 doubler  
649-2839 doubler

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
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| SCALE            | REV                        | SHEET 14                |

Doubler material 2024-T3 .080" thk  
 $F_{tu} = 62000 \text{ psi}$  (Ref 2)



### Tension load capability of doublers

$$P = [4.06 + 5.62 - 2(2.50)] (.080)(62000) = 23213 \text{ lbs}$$

$$\text{M.S.} = \frac{23213}{10,680 + 1274} - 1 = \frac{23213}{11954} - 1 = 1.04$$

### RIVET capability on .056 skin

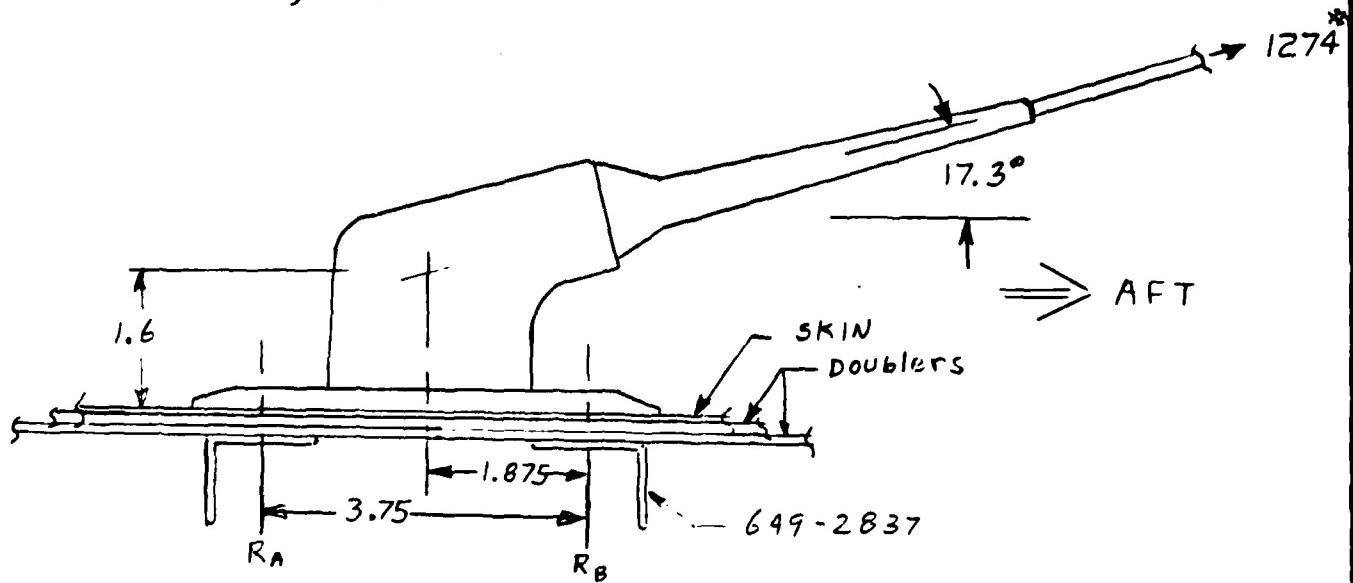
$$\begin{array}{ll} \text{NAS 1097D4} & 442 \text{ lbs} \\ \text{NAS 1097D6} & 977 \text{ lbs} \end{array} \quad \left. \begin{array}{l} \text{Ref 2} \\ \vdots \end{array} \right.$$

$$15(442) = 6630 \text{ lbs}$$

$$8(977) = \frac{7816 \text{ lbs}}{14446 \text{ lbs}}$$

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$$MS = \frac{14446}{11354} - 1 = .27$$



VIEW A-A

Shear load  $1274 \cos 17.3^\circ = 1216 \text{ lbs}$

Tension load  $1274 \sin 17.3^\circ = 379 \text{ lbs}$

Load on aft angle

$$\sum M_{R_F} = 1216(1.6) - 379(1.875) - 3.75 R_F = 329 \text{ lb}$$

Fwd angle

$$\sum F_V 379 - 329 + R_F = 0$$

$R_F = 50 \text{ lbs}$  Tension or Reaction

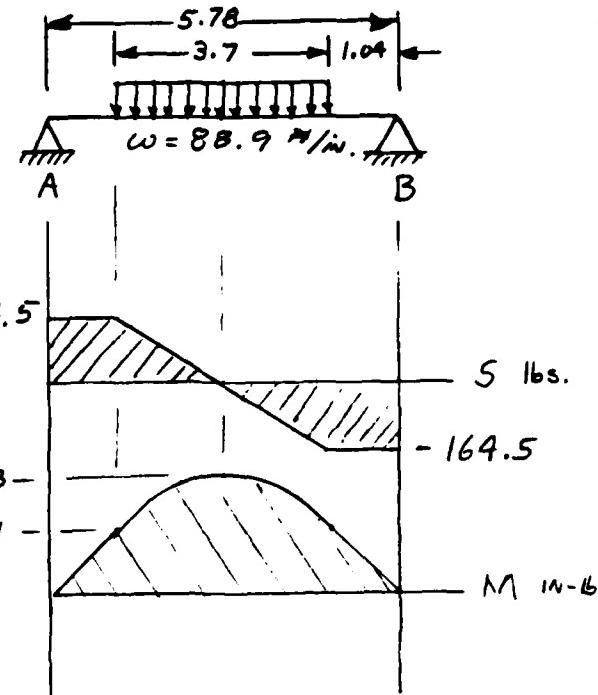
$$\frac{1274}{6} = 112 \text{ lb Shear / Bolt on MS24693}$$

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|       |            | 16           |

Analysis of angle 649-2839

AND 10134-1204

$$I_{xx} = .0124 \text{ in}^4 \quad \bar{y} = .239 \text{ inch.}$$



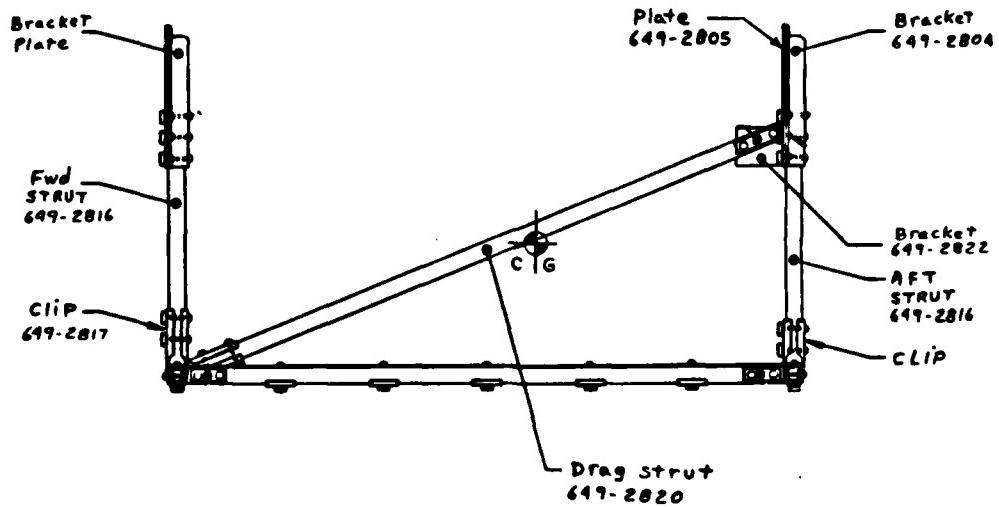
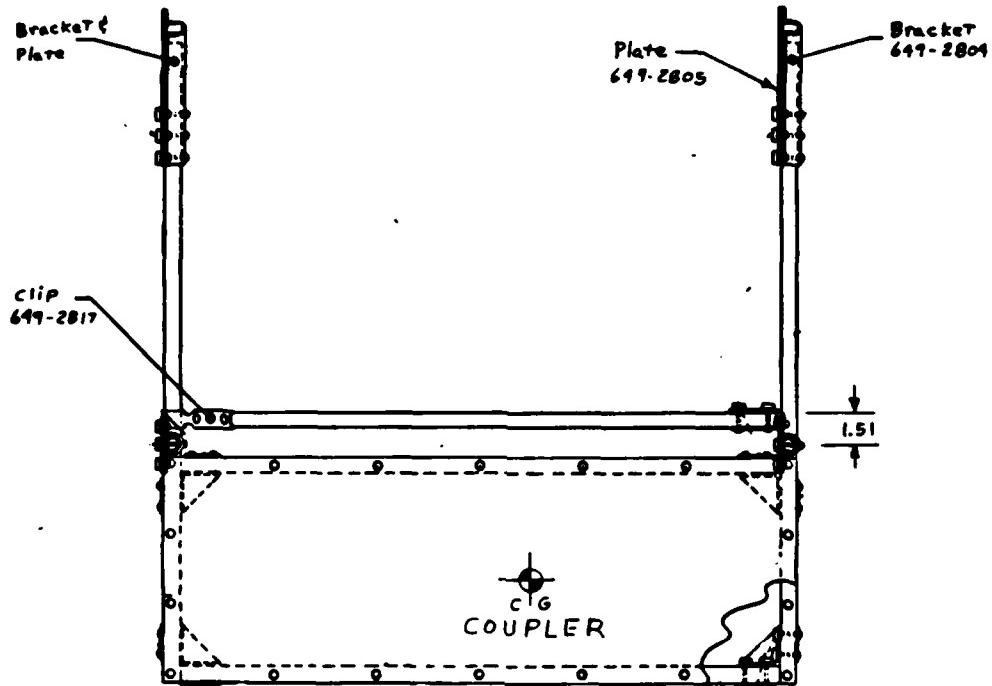
Bending Stress

$$\sigma_B = \frac{323(1-.239)}{.0124}$$

$$\sigma_B = 19840 \text{ psi} \quad \text{M.S. +}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
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d) Coupler mount 649-2806



|       |            |              |
|-------|------------|--------------|
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|       |            | 18           |

d.1)

Design loads per MIL-A-8865

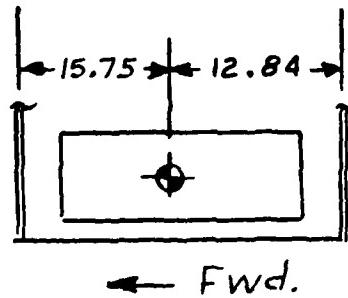
Fwd. 9.0 g

AFT. 1.5 g

Vert. 2.0 g up  
4.5 g down

Lateral 1.5 g

Ultimate loads are 1.5 design



Load distribution on  
vertical supports

Fwd support  $\frac{12.84}{28.59} V_B$

Fwd = .45  $V_B$

AFT = .55  $V_B$

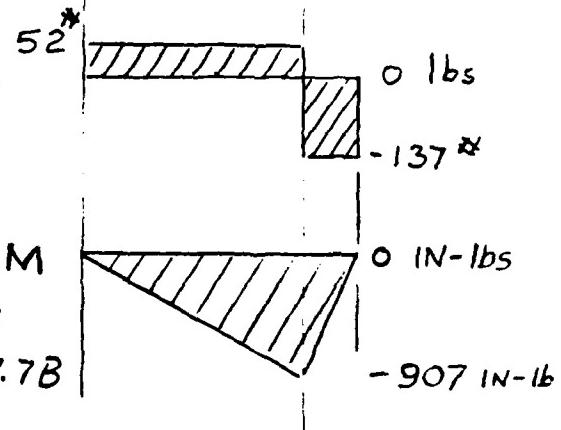
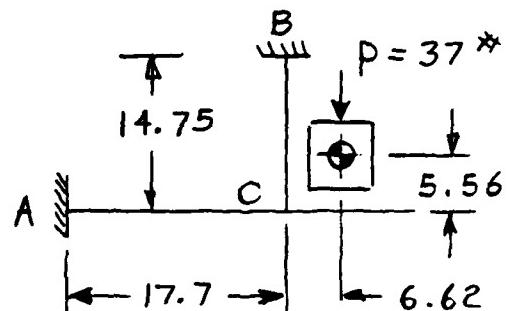
The aft vertical and horizontal  
strut takes the most load.

Therefore analysis will be done  
on aft struts.

Analysis for 6.75 g Vert. down:

$$\sum M_A = .55(37)(24.32)(6.75) - 17.7B$$

$$B_V = 189 \text{ lbs.}$$



|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 19                |

section property of tubular support struts

$$\text{Area} = .168 \text{ in}^2$$

$$I = .00958 \text{ in}^4$$

Stress at Joint C on horizontal strut

$$\sigma_b = \frac{907 (.375)}{.00958} = 35,501 \text{ psi}$$

Mat L properties 2024 T3 tubing

$$F_{tu} = 64,000 \text{ psi} \quad (\text{Ref 2})$$

$$F_{su} = 39,000 \text{ psi}$$

$$MS = \frac{64000}{35501} - 1 \quad \text{Bending} \quad + .80$$

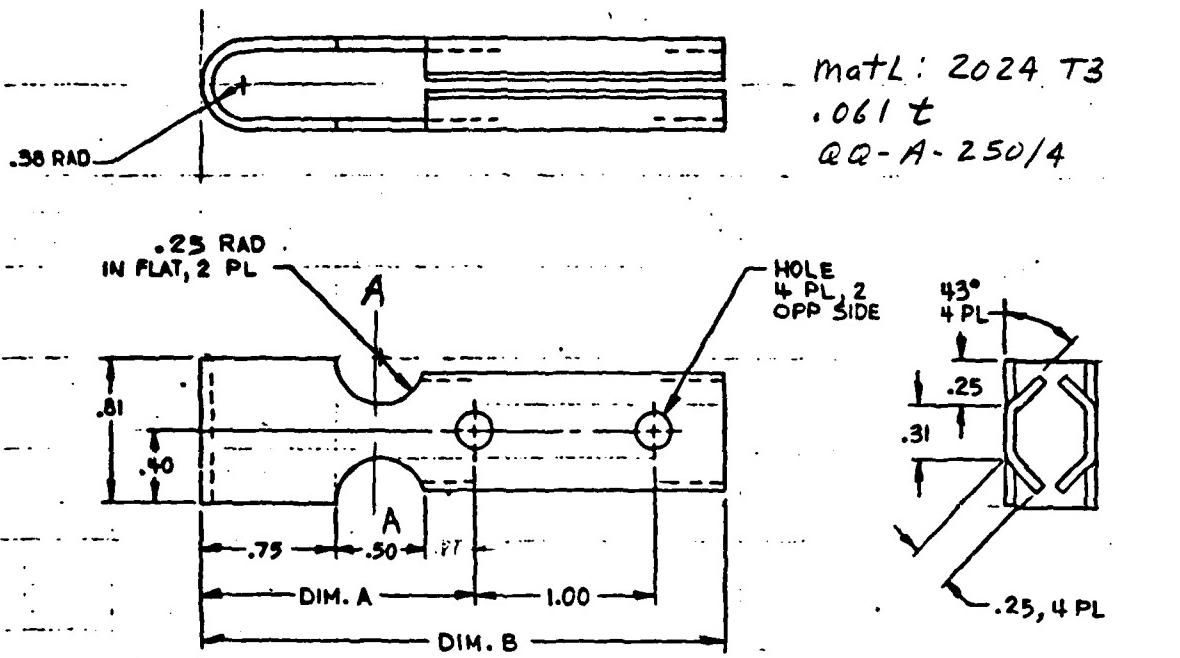
$$\bar{\tau} = \frac{189}{.168} = 1125 \text{ psi}$$

$$MS = \frac{39000}{1125} - 1 \quad \text{Shear} \quad + 33.7$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET<br>20             |

d.2)

Clip 649-2817



$$F_{tu} = 64 \text{ KSC} \quad (\text{Ref F 2})$$

$$F_{bru} = 104 \text{ KSC} \quad (e/d = 1.5)$$

Tension across section A-A

$$H_{rea} = 2(.31)(.061) = .038 \text{ in}^2$$

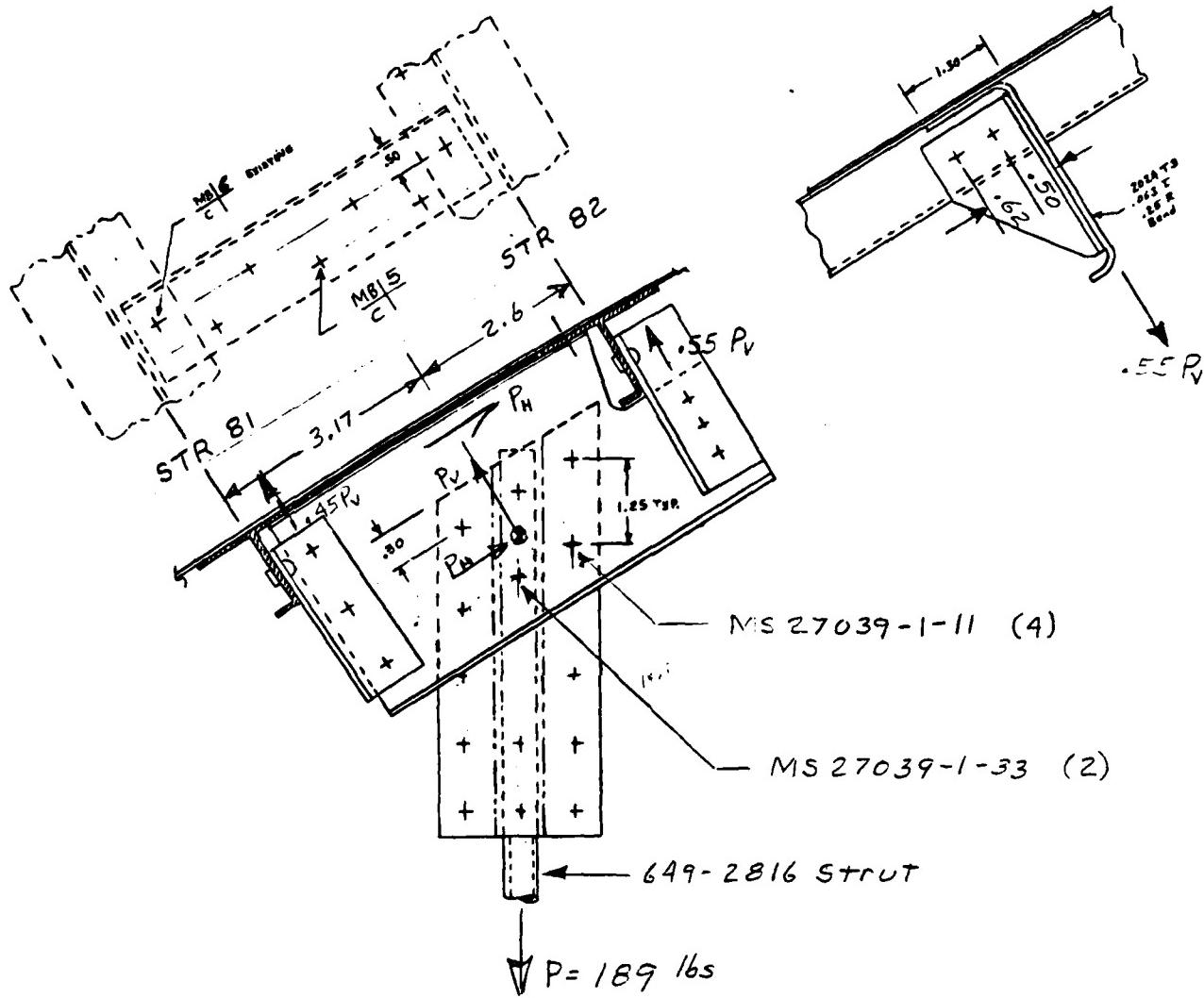
$$P = 189 \text{ lbs} (1.15) \text{ fitting factor} = 217 \text{ lbs}$$

$$\sigma_T = \frac{217}{.038} = 5720 \text{ psi} \quad MS = +$$

$$\sigma_{Br} = \frac{217}{4(.187)(.061)} = 4756 \text{ psi} \quad MS = +$$

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET<br>21             |

d.3) Load in aft Vertical Strut & rivet pattern



MS 27039-1 Screw      Ten. allowable = 2500 lbs  
 Shear = 2125 lbs Single S. ....  
 2024 T3 bearing Allow = 104 Ksc ( $e/d = 1.5$ )

M.S. +

| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | 22           |

$$P_H = 189 \sin 31^\circ = 97 \text{ lbs}$$

$$P_V = 189 \cos 31^\circ = 162 \text{ lbs}$$

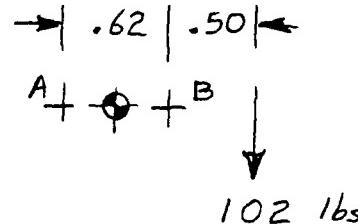
$P_H$  is reacted into the aircraft skin by 2 NAS 1097D6 rivets (787 lbs single shear each) and 5 NAS 1097D5 rivets (615 lbs single shear)

$$\text{Load per rivet} = \frac{97}{7} = 14 \text{ lbs} \quad \text{M.S. +}$$

$P_V$  on stringer \* 82

$$162 \left( \frac{3.17}{5.77} \right) (1.15 \text{ fitting factor}) = 102 \text{ lbs}$$

This load is transferred by 2 MS20470AD4 rivets



Excentric load on rivet

$$P = \frac{.61 (102) (.31)}{2 (.31)^2} = 133 \text{ lbs}$$

$$\text{Axial load} = \frac{102}{2} = 51 \text{ lbs}$$

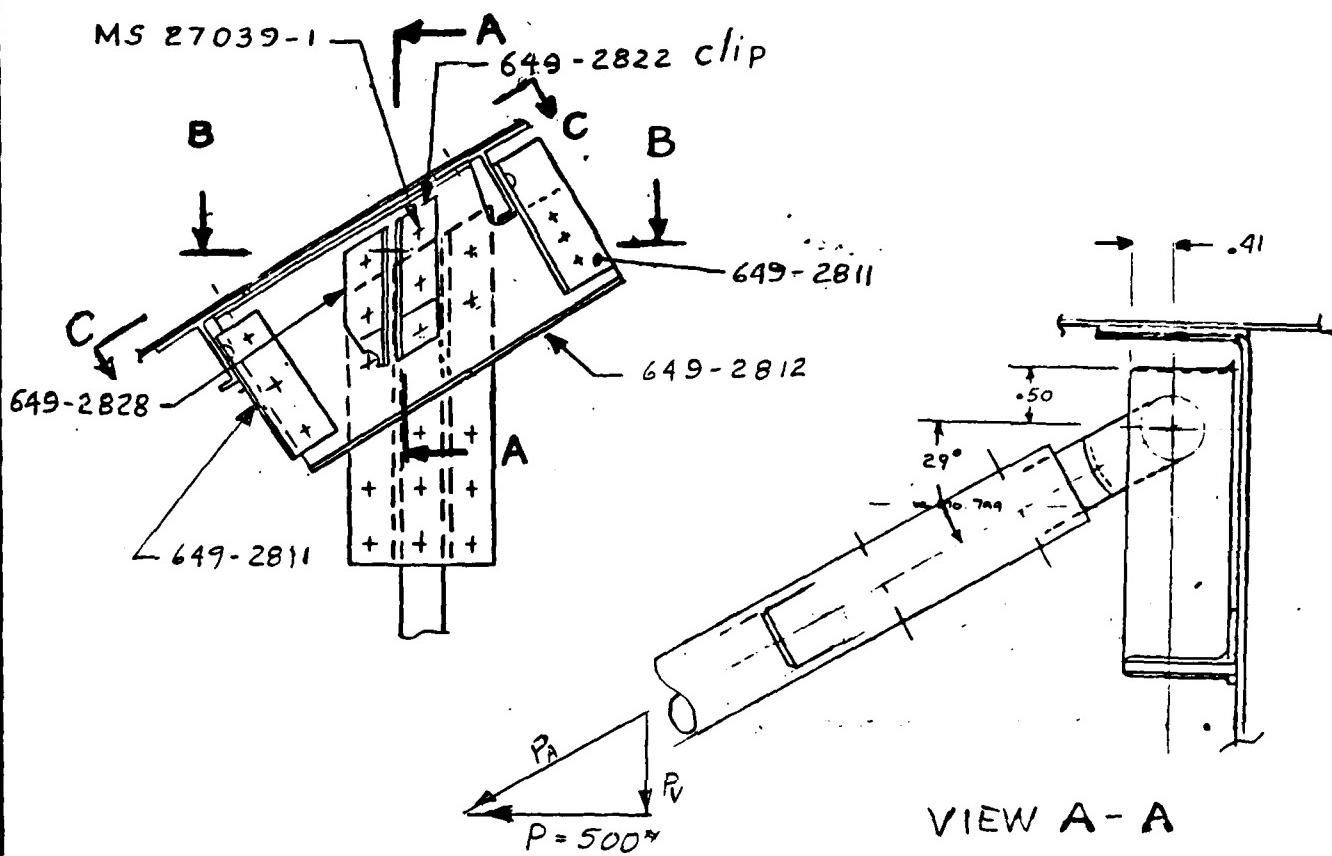
$$\text{Resultant max. load} = 133 + 51 = 184 \text{ lbs}$$

Shear strength of MS 20470AD4 into .063 mat'l. is 388 lbs (ref 2)

$$\text{M.S.} = \frac{338}{184} - 1 = \underline{\hspace{1cm}} - \underline{\hspace{1cm}} - \underline{\hspace{1cm}} + \underline{\hspace{1cm}} .84$$

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET<br>23             |

d.4) ANALYSIS OF DRAG BRACE SYSTEM



$$\begin{aligned} \text{Fwd load} &= 37^{\#}(9g)(1.5) \\ &= 500 \text{ lbs} \end{aligned}$$

AXIAL LOAD IN DRAG BRACE

$$P_A = \frac{500}{\cos 29^\circ} = 572 \text{ lbs}$$

$$S_T = \frac{572}{.168} = 3403 \text{ psi} \quad \text{M.S. +}$$

$$P_V = 500 \tan 29^\circ = 277 \text{ lbs}$$

$$P_V = \frac{277}{5} = 55 \text{ lb/bolt+ M.S. +}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 24                |

↓

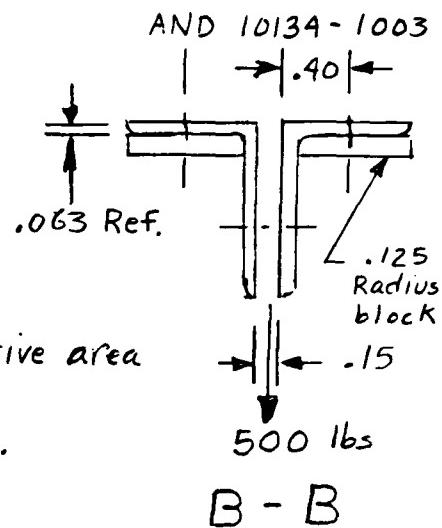
### Analysis of angle clip 649-2822 & 649-2828

Assume all 500 lb load goes into the top two MS27039-1 fasteners.

Assume a section .38 inches wide on each side of fastener resists load

$$I = \frac{.75 (.187)^3}{12} = 4.09 \times 10^{-4} \text{ effective area}$$

$$\sigma_B = \frac{250 (.40) (.093)}{4.09 \times 10^{-4}} = 22,755 \text{ psi}$$



Mat'l Strength for 2024-T3511 extrusion

$$F_{tu} = 54000 \text{ psi LT} \quad (\text{Ref 2})$$

$$F_{su} = 29000 \text{ psi}$$

$$F_{bru} = 108000 \text{ psi } (e/D = 2)$$

$$MS = \frac{54000}{22755} - 1 \quad \underline{\text{Bending}} \quad | 1.37$$

Clip Shear at heel

$$\Sigma = \frac{250}{.063 (.40)} = 4960 \text{ psi MS +}$$

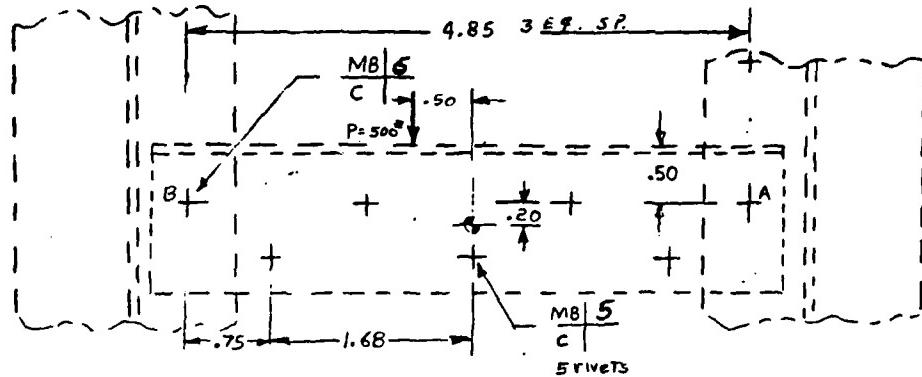
Bearing from 500 # load

$$\Sigma_B = \frac{250}{(.187)(.063)} = 21,221 \text{ psi MS +}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 25                |



Fore - Aft Drag load is carried into top skin  
by 2 ~ NAS 1097D6 rivets and 5 ~ NAS 1097D5 rivets



VIEW C - C

Torsional shear stress on rivets A & B

$$\begin{aligned}\tau_t &= \frac{500 (.50) (2.42)}{2[(2.43)(.028) + (1.702)(.019) + (.833)(.019)] + .3 (.019)} \\ &= \frac{605}{236} = 2561 \text{ psi}\end{aligned}$$

Axial shear stress :

$$\tau_a = \frac{500}{2(.028) + 5(.019)} = 3311 \text{ psi}$$

Total shear stress on rivet B :

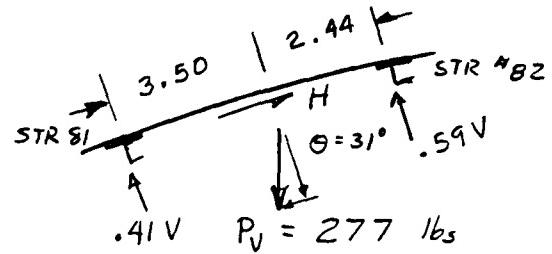
$$\tau_{tot} = 2561 + 3311 = 5872 \text{ psi} \quad \text{M.S. +}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 26                |

The vertical load produced by the drag load is carried by the 649-2812 channel to the aircraft stringers thru the 649-2811 clips. The clips are secured to the stringers by 2 ~ MS20470AD4 rivets.

Vertical load to stringers

$$V = 277 \cos 31^\circ = 237 \text{ lbs}$$



Shear load to skin

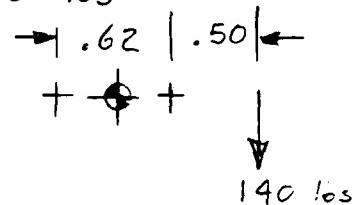
$$H = 277 \sin 31^\circ = 143 \text{ lbs}$$

Stringer #82 has the greater load due to forward loading.

Vertical load str #2 = .59 (237) = 140 lbs

Excentric load on rivets

$$P = \frac{.81(140)(.31)}{2(.31)^2} = 183 \text{ lbs}$$



$$\text{Axial load} = \frac{140}{2} = 70 \text{ lbs}$$

Resultant maximum load = 253 lbs

Shear strength of MS20470AD4 into .063 mat -  
is 388 lbs (Ref 2)

$$M.S. = \frac{388}{253} - 1 = \underline{\quad} \quad \underline{.53}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 27                |

The H component of the vertical load is 193 lbs which is sheared into the skin by 7 rivets

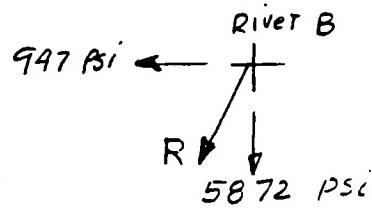
$$\text{Stress on rivets} = \frac{193}{2(0.028) + 5(0.019)} = 947 \text{ psi}$$

$$\text{Load on Rivet B} = 947(0.028) = 26.5 \text{ lbs}$$

The resultant stress on rivet B (max. stressed rivet)

$$is \sqrt{(5872 \text{ psi})^2 + (947 \text{ psi})^2}$$

$$R = 5948 \text{ psi}$$



Allowable shear stress on 2017-T31

(D) rivet is 34000 psi (Ref 2)

$$M.S. = \frac{34000}{5948} - 1 = 4.72$$

(e) SUMMARY

The analysis shows that the design is of sufficient strength to carry all induced loads with the following minimum margins-of-safety

Tension M.S. = 0.80 (P. 20)

Bearing M.S. = 0.13 (P. 13)

Rivet attachment M.S. = 0.27 (P. 16)

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET 28                |

3.0 UPS-192 H.F. RECEIVE ANTENNA INSTL  
DWG. NO. 649-2797-001

The antenna is mounted on the bottom of the fuselage at F.S. 846, LBL 2.95. The modification consists of a doubler 4.25" x 8.00" x .080 thk. attached to the inside of the fuselage skin by 34 NAS 1097 D5 rivets. There is one .906 diameter hole drilled in the center of the doubler.

Reference Drawings

649-2797 Installation  
649-2796 Doubler

(a) Consider Compression load in bottom skin

Load lost by cutout in skin  
skin is 7079 T6 clad .071 thk (Ref 1)

$F_{cy} = 62,000 \text{ psi}$  (Ref 2)

$$P_{lost} = 62000 (.071)(.903 + .218 + .218)$$

$$P_{lost} = 5894 \text{ lbs}$$

Load capability of doubler  
matL 2024 T3 .080 thk.

$$F_{cy} = 39000 \text{ psi}$$

$$P_{capability} = 39000 (4.08_{eff} - 1.339)(.080) = 8552 \text{ lbs}$$

$$\text{M.S.} = \frac{8552}{5894} - 1 \quad \underline{\quad \quad \quad \quad \quad \quad \quad \quad} \quad .45$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 29                |

(b) Buckling of Sheet

critical buckling stress of original aircraft panel

$$\sigma_{cr} = \frac{\pi^2 k_c E}{12(1-\mu^2)} \left(\frac{t}{b}\right)^2$$

$$\text{for } \frac{b}{t} = \frac{5.1}{.071} = 72 \quad k_c = 5.5 \quad (\text{Ref 4 P.C5.3})$$

$$\sigma_{cr} = 10,330 \text{ psi}$$

critical buckling of doubler

$$b_w = 4.24 - .08 = 4.16$$

$$b_f = .75 - .04 = .71$$

$$\frac{b_f}{b_w} = .17$$

$$\frac{t_w}{t_f} = 1.0$$

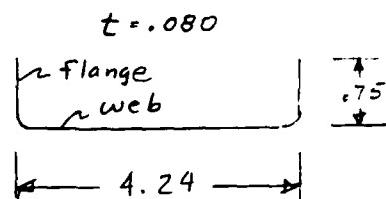
$$k_w = 4.6 \quad (\text{Ref 4 P.C6.3})$$

$$\sigma_{cr} = \frac{k_w \pi^2 E}{12(1-\mu^2)} \left(\frac{t_w}{b_w}\right)^2 = 16,801 \text{ psi} \quad \text{in web}$$

compressive load on doubler

$$P_c = \frac{5894}{.946} = 13203 \text{ psi}$$

$$\text{M.S.} = \frac{16801}{13203} = 1 \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{.37}$$



|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 30                |

(C) Rivets required to transfer load

NAS 1097 D5 P = 755 (Ref 2)

$$\# \text{ rivets} = \frac{58.94}{7.55} = 7.8 \text{ rivets}$$

No. rivets in design INSTL. = 17

$$MS = \frac{17}{8} - 1 \quad - \quad - \quad - \quad + \quad 1.12$$

(d) Summary

The analysis of this installation shows that it is of sufficient strength to carry the load.

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 31                |

## 4.0 4375-1C VHF/FM ANTENNA INSTALLATION

Two VHF/FM Antennas are mounted on the underside of the aircraft at F.S. 529.00 E L & R BL 48.5. A third antenna is mounted atop the Inflight Refueling housing at F.S. 507 C

Reference Drawings :      649-2884      Installation  
                                649-2900      Installation  
                                649-2898      Doubler

### (a) 649-2900 Installation

The two lower antennas are in line with the flight of the aircraft and have a maximum drag of 2.55 lbs at 510 mph 30,000 ft altitude.

During take off and landing the antennas experience a side load due to the angle of attack with the airstream.

The cross sectional area of the antenna is 168 in<sup>2</sup> (1.17 ft<sup>2</sup>)

Assume maximum angle of attack of 14° during take off rotation at M = 0.48

The antenna blade will be treated as a flat plate for side load analysis

Dynamic pressure at sea level

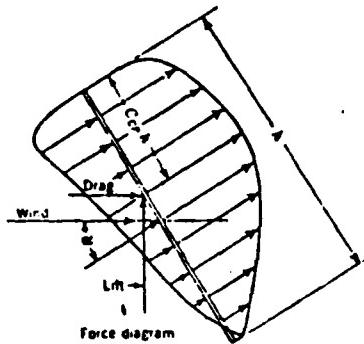
$$C = 1118 \text{ FPS}$$

$$\rho = .002378 \text{ lb sec}^2/\text{ft}^4$$

$$V = 200 (1.688) = 338 \text{ FT/sec}$$

$$S = \frac{1}{2} (.002378) (338)^2 = 135.51 \text{ lb/ft}^2$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 32                |



(d) INCLINED PLATE

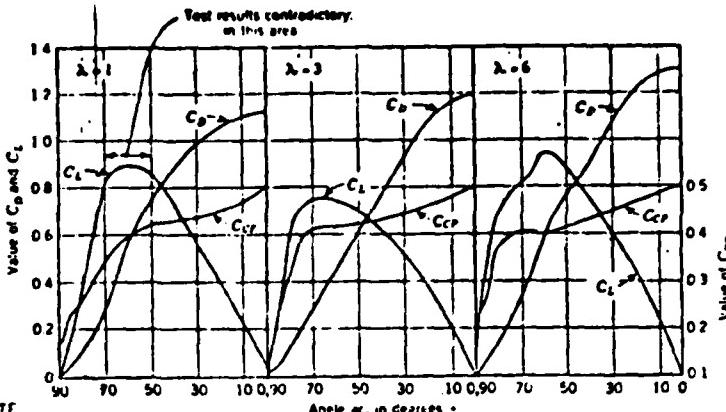
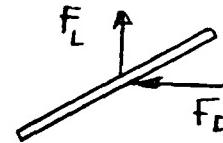


FIG. 5.—WIND PRESSURES ON ELEMENTARY BODIES

(FROM ASCE PAPER 3269)

for  $\lambda = 1.6$  at  $\alpha = 76^\circ$

$$C_D = .21 \quad C_L = .67 \quad C_{CP} = .51$$



At takeoff rotation

$$F_D = C_D A g \\ = .21 (1.17)(135.5) = 33.3 \text{ lbs}$$

$$F_L = C_L A g$$

$$= .67 (1.17)(135.5) = 106.2 \text{ lbs}$$

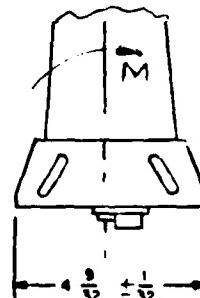
At sea level, antenna cross section drag = 1.64 lbs

Center of pressure on the antenna  $\bar{x} = 7.49''$

$$F'_D = 33.3 + 1.64 = 34.94 \text{ lbs}$$

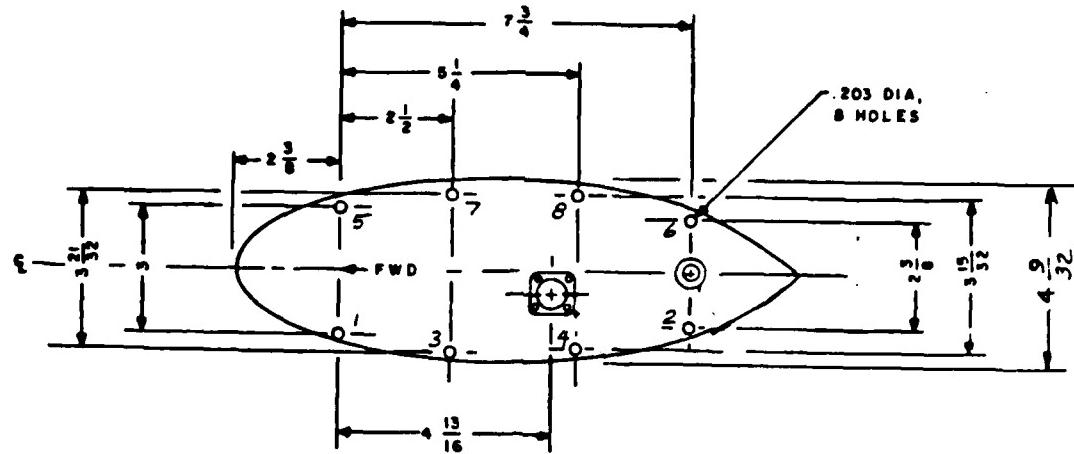
$$F'_L = 106.2 \text{ lbs}$$

$$M = (106.2 + 34.94)(7.49) = 1057 \text{ in-lb}$$

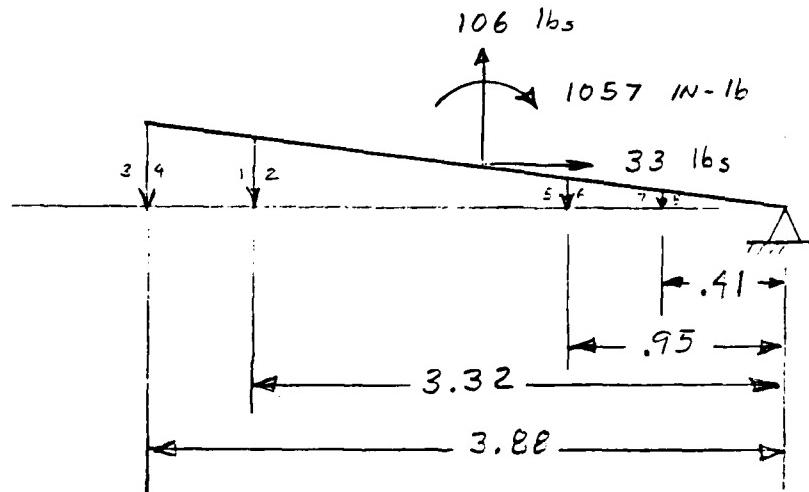


|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET      33           |

## Antenna attachment loads



Assumption: The antenna stiffness is of such magnitude that the antenna tends to rotate as a rigid body about its edge



Bolt tension due to lift

$$F_L = \frac{106}{8} = 13.25 \text{ lbs}$$

| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 34     |

Drag load Per bolt

$$F_D = \frac{3.3}{8} = 4.1 \text{ lbs}$$

Load due to Moment

$$M = \frac{2F}{3.88} \left[ (3.88)^2 + (3.22)^2 + (.95)^2 + (4.1)^2 \right]$$

$$M = 13.66 F$$

$$F = \frac{1057}{13.66} = 77.4 \text{ lbs}$$

Summation of loads

Bolts # 1 & 2  $F_D = 4.1 \text{ lbs}$

$$F_L = 13.25 + \frac{3.32}{3.88} (77.4) = 79.5 \text{ lbs}$$

Bolts # 3 & 4  $F_D = 4.1 \text{ lbs}$

$$F_L = 13.25 + 77.4 = 90.6 \text{ lbs}$$

Bolts # 5 & 6  $F_D = 4.1 \text{ lbs}$

$$F_L = 13.25 + \frac{.95}{3.88} (77.4) = 32.2 \text{ lbs}$$

Bolts # 7 & 8  $F_D = 4.1 \text{ lbs}$

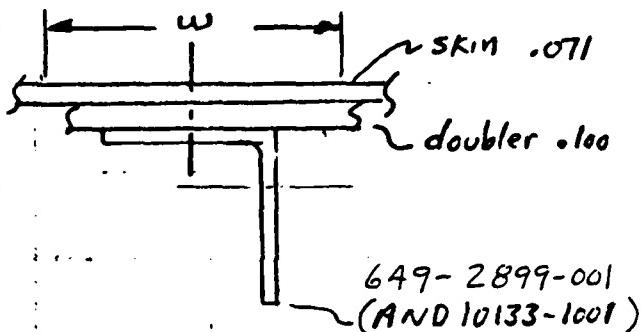
$$F_L = 13.25 + \frac{.41}{3.88} (77.4) = 21.4 \text{ lbs}$$

Pivot Point

$$\sum F_L = -223.7 + 106 = -117.7 \text{ lbs}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 35                |

Section properties of angle installation



Effective width of skin

$$w = 1.9 t \sqrt{E/F_{cy}}$$

skin : 7475-T761

$t = .071$  (Ref L.A.C. Dwg 3F30503)

$F_{cy} = 60,000 \text{ psi}$  (Ref 2)

$F_{tu} = 71,000 \text{ psi}$

$$w_{\text{skin}} = 1.9 (.071) \sqrt{\frac{10^7}{60 \times 10^3}} = 1.74 \text{ inches}$$

Effective width of doubler

mat L : 2024-T3 .100 thk

$F_{cy} = 37,000 \text{ psi}$  (Ref 2)

$F_{tu} = 62,000 \text{ psi}$

$w_{\text{doubler}} = 3.23$

Moment of inertia of skin, doubler and angle

$$I = .0326 \text{ in}^4 \quad \bar{y} = .172 \text{ inches}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 36                |

Reactions on Angle 649-2899-001 (worst case)

- ANGLE - ANTENNA ATTACHMENT

\*\*\*\*\*  
\* ICES STRUDL-II  
\* THE STRUCTURAL DESIGN LANGUAGE  
\*\*\*\*\*

\* CIVIL ENGINEERING SYSTEMS LABORATORY  
\* MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
\* CAMBRIDGE, MASSACHUSETTS

\* 14.24.47 09 OCT 80

\* UNIVAC 1100 SERIES EXEC 8  
\* VERSION 2.7

PREPARED BY MAARTEN VET

NODE COORDINATES

X Y

|   |      |      |         |
|---|------|------|---------|
| 1 | 0.00 | 0.00 | SUPPORT |
| 2 | 1.04 | 0.00 |         |
| 3 | 4.74 | 0.00 |         |
| 4 | 5.92 | 0.00 |         |
| 5 | 5.82 | 0.00 | SUPPORT |

TYPE PLANE FRAME

MEMBER INCIDENCES

|   |   |   |
|---|---|---|
| 1 | 1 | 2 |
| 2 | 2 | 3 |
| 3 | 3 | 4 |
| 4 | 4 | 5 |

MEMBER PROPERTIES

1 1 4 AX .5568 IZ .0326 SZ .0326

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 37                |

CONSTANTS

E 1.00E7 ALL

G 3.80E6 ALL

LOADING "DRAG"

NODE LOADS

2 FORCE Y +90.6  
3 FORCE Y +21.4  
4 FORCE Y -54.8

Assumptions: 1/2 pivot point load is taken by this angle

STIFFNESS ANALYSIS

UNITS KIPS

OUTPUT DECIMAL 4

LIST FORCES,REACTIONS,DISPLACEMENTS ALL

OUTPUT DECIMAL 3

LIST MAX STRESS,EACH LOAD,ALL MEMBERS,SECT FR DS 0.00 0.20

|                  |                            |                        |
|------------------|----------------------------|------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-297-001 |
| SCALE            | REV                        | SHEET 38               |

UNIVAR LOAD STATUS LOTS

DATE 100980 PAGE 3

\*\*\*\*\*  
PRINTS OF LATEST ANALYSIS  
\*\*\*\*\*

PROBLEMS - ANGLE TITLE = ANTENNA ATTACHMENT

ACTIVE JOINTS INCH KIPS RADIAN DEG SECUND

ACTIVE STRUCTURE TYPE: PLANE FRAME

ACTIVE COORDINATE AXES X Y

LOADING - DRAGS

MEMPHIS FORCES

| MEMPHIS | JOINT | FORCES |         |           | MOMENTS |         |          | BENDING  |          |       |       |
|---------|-------|--------|---------|-----------|---------|---------|----------|----------|----------|-------|-------|
|         |       | AXIAL  | SHEAR Y | TORSIONAL | X FORCE | Z FORCE | X MOMENT | Y MOMENT | Z MOMENT | X ROT | Z ROT |
| 1       | 1     | *0000  | *0013   |           |         |         |          |          |          | *0026 |       |
| 1       | 2     | *0000  | *0013   |           |         |         |          |          |          | *0020 |       |
| 2       | 2     | *0000  | *0093   |           |         |         |          |          |          | *0250 |       |
| 2       | 5     | *0000  | *0093   |           |         |         |          |          |          | *0000 |       |
| 3       | 3     | *0000  | *0307   |           |         |         |          |          |          | *0000 |       |
| 3       | 4     | *0000  | *0307   |           |         |         |          |          |          | *0176 |       |
| 4       | 4     | *0000  | *0281   |           |         |         |          |          |          | *0116 |       |
| 4       | 5     | *0000  | *0281   |           |         |         |          |          |          | *0039 |       |
|         |       |        |         |           |         |         |          |          |          |       |       |

RESISTANT JOINT LOADS - SUPPORTS

| JOINT | FORCES  |         |         | MOMENTS  |          |          | ROTATIONS |       |       |       |
|-------|---------|---------|---------|----------|----------|----------|-----------|-------|-------|-------|
|       | X FORCE | Y FORCE | Z FORCE | X MOMENT | Y MOMENT | Z MOMENT | X ROT     | Y ROT | Z ROT |       |
| 1     | GLO     | *0000   | *0013   |          |          |          |           |       |       | *0026 |
| 1     | GLO     | *0000   | *0281   |          |          |          |           |       |       | *0009 |
|       | TOTALS  | *0000   | *0532   |          |          |          |           |       |       | *0677 |
|       |         |         |         |          |          |          |           |       |       |       |

UNIVERSITY JOINT DISPLACEMENTS - SUPPORTS

| JOINT | DISPLACEMENTS |         |         | ROTATIONS |       |       |
|-------|---------------|---------|---------|-----------|-------|-------|
|       | X DISPL       | Y DISPL | Z DISPL | X ROT     | Y ROT | Z ROT |
| 1     | *0.001        | *0.000  | *0.000  |           |       |       |
|       |               |         |         |           |       |       |

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 39                |

UNIVAC AND STREETS ICES

DATE 100980

PAGE

RESULTANT JOINT DISPLACEMENTS - FREE JOINTS

| JOINT | X DISPL | Y DISPL | Z DISPL | X ROT | Y ROT | Z ROT  |
|-------|---------|---------|---------|-------|-------|--------|
| 2     | .000    | .000    | .000    | .0001 | .0001 | .0001  |
| 3     | .000    | .000    | .000    | .0000 | .0000 | -.0000 |
| 4     | .000    | .000    | .000    | .0000 | .0000 | -.0000 |

INTERNAL MEMBER RESULTS

MEMBER MAXIMUM STRESS FOR EACH LOADING

MEMBER 1

| LOADING | MAX NORMAL AT SECTION | MIN NORMAL AT SECTION |
|---------|-----------------------|-----------------------|
| DRAG    | 1.927 .0000 FR        | -1.927 .0000 FR       |

MEMBER 2

| LOADING | MAX NORMAL AT SECTION | MIN NORMAL AT SECTION |
|---------|-----------------------|-----------------------|
| DRAG    | .767 .0000 FR         | -.767 .0000 FR        |

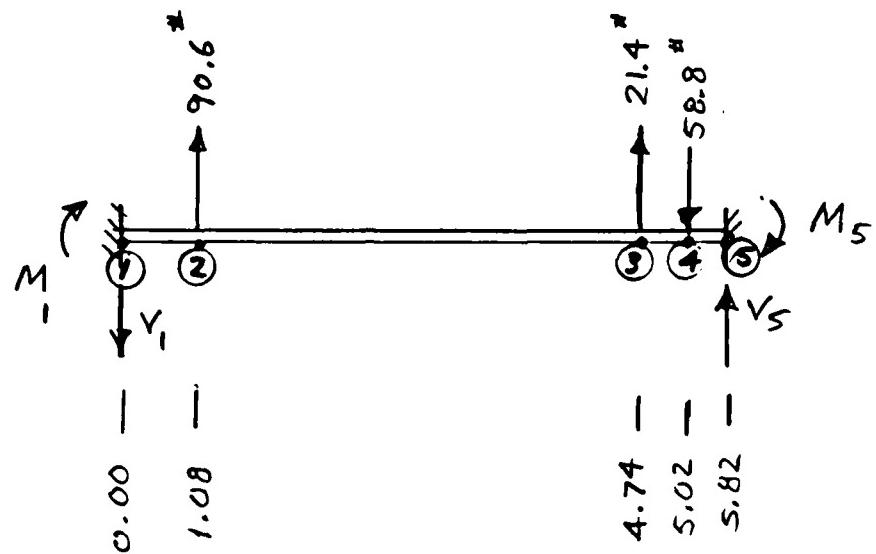
MEMBER 3

| LOADING | MAX NORMAL AT SECTION | MIN NORMAL AT SECTION |
|---------|-----------------------|-----------------------|
| DRAG    | .540 1.0000 FR        | -.540 1.0000 FR       |

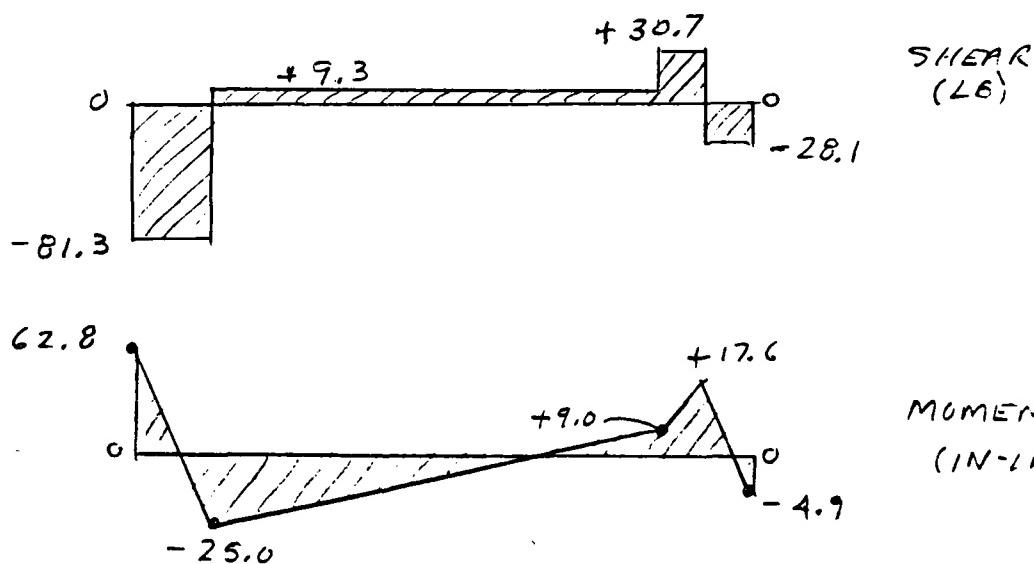
MEMBER 4

| LOADING | MAX NORMAL AT SECTION | MIN NORMAL AT SECTION |
|---------|-----------------------|-----------------------|
| DRAG    | .540 .0000 FR         | -.540 .0000 FR        |

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 40                |



ASSUMPTION: THE NAS 623 FASTENERS ATTACHING THE ANGLE TO THE BEAM CAN TRANSFER MOMENT INTO THE A/C ZEE SECTION



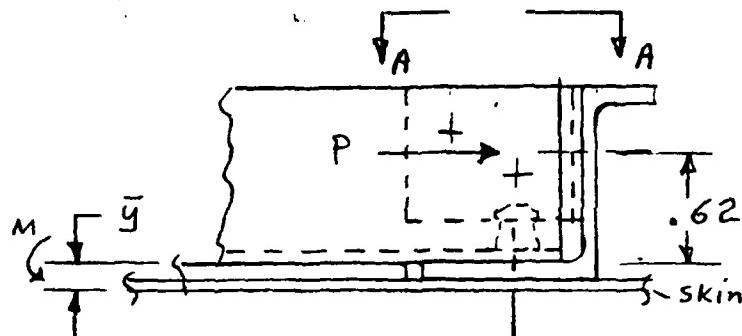
|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 41                |

## Maximum bending Stress

$$\text{C}_B = \frac{62.8 (1.00)}{.0326} = 1926 \text{ psi}$$

$$MS = \frac{34000}{1926} - 1 \quad - \quad - \quad - \quad - \quad | \quad 16.6$$

End moment on clip 649-2895-002



Moment M is reacted by 2 MS 20470 RIVETS  
since the N.A. is even with bottom of doubler

$$P = \frac{62 \cdot 8}{62} = 101 \text{ lbs}$$

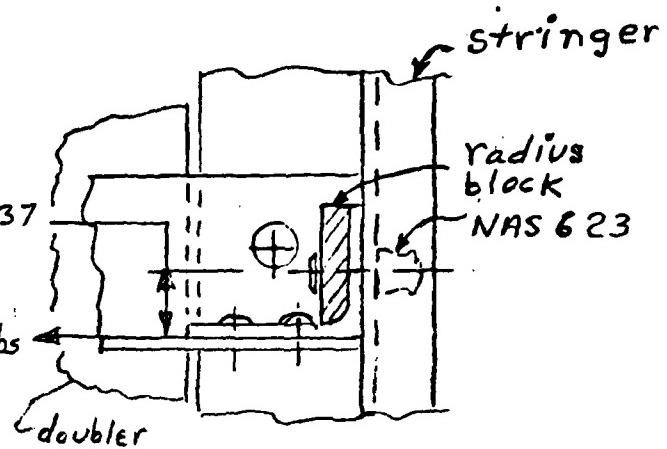
This load is reacted by 2 MS20470D4 which have a single shear strength of 442 lbs

$$MS = \frac{884}{101(1.5)} - 1 = - - - - + 4.8$$

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET      42                  |

USE .190 thick radius  
block to force P load  
into corner of Angle  
as a tension load  
rather than a bending  
load around angle corner.

$$P = 101 \text{ lbs}$$



VIEW A-A

NAS 623-2 bolts will withstand an ultimate tensile strength of 1740 lbs

M.S. +

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 43                |

↓

(b) Connector CUTOUT in Skin

Load capability in skin lost

$$P_{lost} = 71000 (1.12 + .218 + .218)(.071) = 7844 \text{ lbs}$$

the 649-2898 doubler must pick up this load

$$62000 (3.95 - 1.12 - .218 - .218)(.10) = 14843 \text{ lbs}$$

$$MS = \frac{14843}{7844} - 1 = \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad | .89$$

Rivets required to transfer load. Use NAS 1097 D5,  
ultimate single shear strength = 690 lbs (Ref 2)

$$\frac{7844}{690} = 11.4 = 12 \text{ rivets}$$

Rivets installed:

$$12 \text{ NAS 1097 D5} \quad 8280 \text{ lbs}$$

$$4 \text{ NAS 1097 AD3} \quad \frac{1492 \text{ lbs}}{9772 \text{ lbs}}$$

$$MS = \frac{9772}{7844} - 1 = \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad | .24$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 44                |



(C) 649-2884 INSTALLATION

No analysis will be run on the 437S-1C installation on the inflight refueling housing since the antenna at all times is parallel to the line of flight, maximum drag load is 2.55 lbs and the I.R. housing does not carry major structural loads. Any side loads due to yaw maneuvers or roll maneuvers is transferred as shear into the skin and to the structural member of the housing.

Doubler installation (649-2888 doubler)

Load lost by cutout :

Skin : 7079-T6 clad .053 thk (Ref 1)

$F_{tu} = 69000 \text{ psi}$  (Ref 2)

$$P = 69000(.75)(.053) = 2743 \text{ lbs}$$

Doubler 2024 T3 .063 thk

$F_{tu} = 62000 \text{ psi}$

$$P_{\text{capability}} = 62000(2.5 - .75)(.063) = 6835 \text{ lbs}$$

$$\text{MS} = \frac{6835}{2743} - 1 = \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} + 1.49$$

Number M520470AD4 rivets required to transfer Load. Single shear strength = 388 lbs (Ref 2)

$$\text{Rivets Regd} = \frac{2743}{388} = 7$$

Rivets installed = 10

$$\text{M.S.} = \frac{10}{7} - 1 = \underline{\quad}$$

0.43

| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 45     |

(d) Summary

The analysis of the 9375-1C antenna installation shows that it is of sufficient strength to carry the induced loads with the following margins-of-safety

Tensile M.S. = 0.89 (P. 44)

Rivet Shear M.S. = 0.24 (P. 44)

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 46                |

5.0 SATCOM ANTENNA INSTALLATION

DWG. NO 649-2851

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 47                |

Satcom skin doubler installation

Ref dwg 649-2851 Installation  
649-2871 Doubler

the doubler is mounted on the pressure skin  
at F.S. 654, LBL 23.0

Strength lost in original skin by cutout

Aircraft skin 7079-T6 clad .053 thk (Ref 1)

$F_{tu} = 69,000 \text{ psi}$  (Ref 2)

$$P_{lost} = 69000 (.053)(.765) = 2998 \text{ lbs}$$

Capability of doubler

2024 T3 .063 thk

$F_{tu} = 60,000 \text{ psi}$  (Ref 2)

$$P_{capability} = 60,000 (2.50 - .765)(.063) = 6558 \text{ lbs}$$

$$MS = \frac{6558}{2998} - 1 \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad + 1.34$$

Rivets required to transfer load

use 6 MS 20470 D5 RIVETS

$P_{rivet} = 675 \text{ lbs}$  (Ref 2)

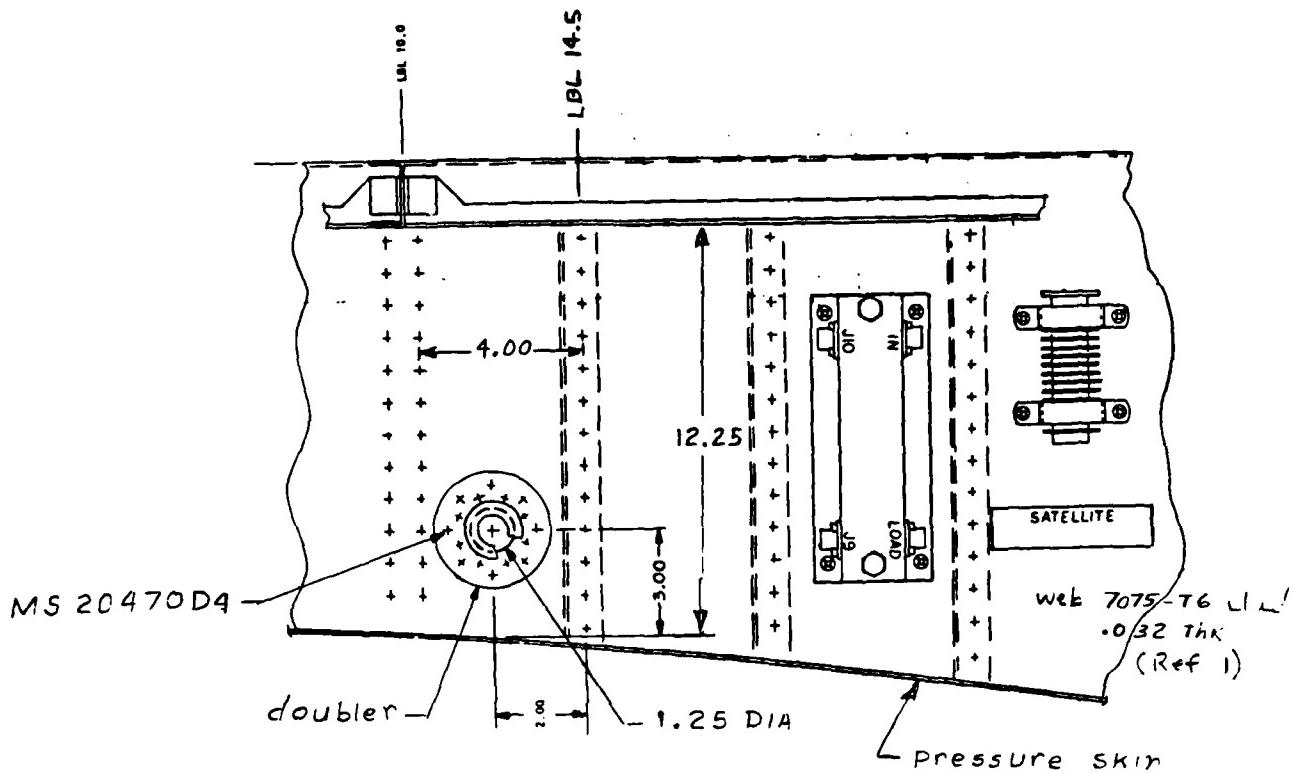
$$\text{Rivets required } \frac{2998}{675} = 4.4 \text{ rivets}$$

$$M.S. = \frac{6}{4.4} - 1 \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad + .36$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 48                |

F.S. 663 Doubler installation

Ref dwg: 649-2918 doubler.



VIEW LWK AFT  
F.S. 663

Buckling Stress in Part!

$$S = 12.25$$

$$k = 4$$

$$a/b = 3.06 \quad K = 5.02 \quad (\text{Ref 4 Table 3E-4})$$

$$S_{cr} = 5.02 \left( \frac{10.3 \times 10^6}{.89} \right) \left( \frac{.032}{4} \right)^2 = 3718 \text{ PSI}$$

$$\gamma = 3718 (.032) = 119 \text{ #/inch}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 49                |

Tension load capability lost by cutout

web  $F_{tu} = 70,000 \text{ psi}$  (Ref 2)

$$P = 1.25(.032)(70000) = 2800 \text{ lbs}$$

Doubler: 2024 T3  $F_{tu} = 62000 \text{ psi}$

$$\text{Doubler strength} = .050(2.00)(62000) = 6200 \text{ lbs}$$

$$\text{MS.} = \frac{6200}{2800} - 1 \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad + \underline{\quad 1.21 \quad}$$

load transfer from web to doubler

MS 20470D4 rivet Single shear strength for .032 matl

$$411 \text{ lbs (.964)} = 396 \text{ lbs}$$

8 rivets are used on each symmetry line

$$8(396) = 3168 \text{ lbs}$$

$$\text{MS} = \frac{3168}{2800} - 1 \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad \underline{\quad} \quad + \underline{\quad 0.13 \quad}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 50                |

SUMMARY

AN ANALYSIS WAS PERFORMED ON THE HONEYCOMBY AIRCRAFT PANEL, P/N 3W12010, TO DETERMINE ITS CAPABILITY TO REACT THE FORCES INDUCED INTO IT BY THE UHF ANTENNA DUE TO AERODYNAMIC LOADING. AS THE ANALYSIS PROGRESSSED, IT WAS DETERMINED THAT THE ANTENNA SHOULD HAVE A ZERO ANGLE OF ATTACK, RATHER THAN THE 7-DEGREES USED IN THE ANALYSIS: THUS, THE ANALYSIS IS SOMEWHAT TRUNCATED. HOWEVER, THE ANALYSIS DID SHOW THAT THE PANEL IS MORE THAN ADEQUATE TO TAKE OUT THE SHEAR AND BENDING LOADS INDUCED BY THE ANTENNA.

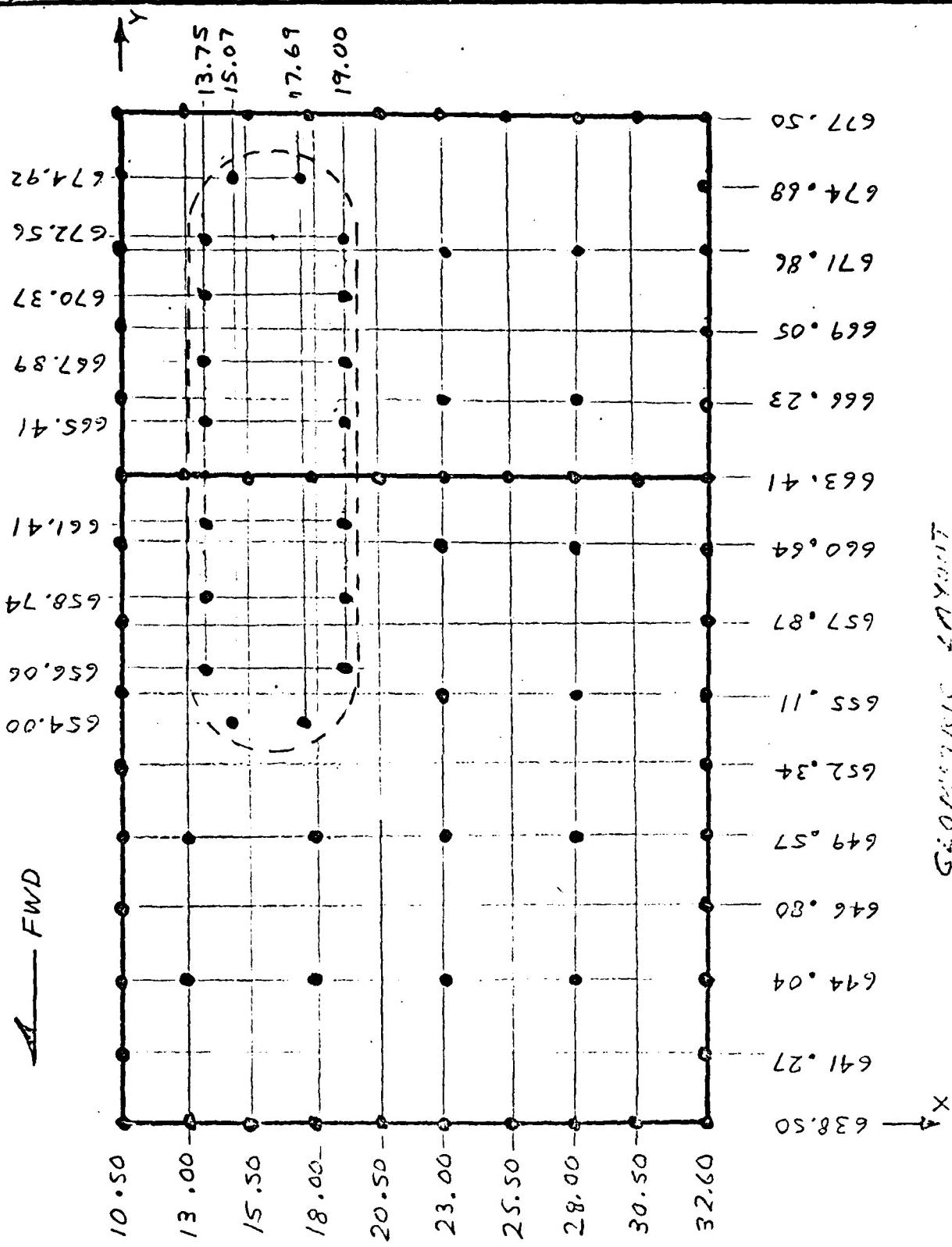
|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET    51                    |

## 1.0 ANALYTICAL MODEL

AN ANALYTICAL MODEL WILL BE MADE OF THE HONEYCOMB AIRCRAFT PANEL TO WHICH THE ANTENNA ATTACHES (SEE LAYOUT THAT FOLLOWS). THE PANEL WILL BE MODELED USING TRIANGULAR FLAT-PLATE ELEMENTS HAVING BOTH SHEAR AND BENDING CAPABILITY. THE ANTENNA WAS ASSUMED TO BE ATTACHED DIRECTLY TO THE AIRCRAFT PANEL WITH THROUGH-BOLT INSERTS IMPLANTED BETWEEN THE HONEYCOMB FACINGS AT EACH ATTACHMENT LOCATIONS. IT SHOULD BE NOTED THAT IN THIS ATTACHMENT CONFIGURATION, THE ANTENNA HAS A NORMAL ANGLE OF ATTACK OF 7-DEGREES.

BECAUSE THE STRUCTURAL COMPUTER CODE USED IN THE ANALYSIS DOES NOT HAVE A HONEYCOMB FINITE ELEMENT IN ITS LIBRARY, AN OVERLAY ELEMENT WAS FABRICATED FOR THIS PURPOSE WITH THE TRUE SHEAR THICKNESS AND AN ARTIFICIAL FLEXURAL MODULUS SO AS TO YIELD THE CORRECT FLEXURAL STIFFNESS.

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET      52                  |



|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 53                |

'C141-B'    'DM C34-3/B UHF ANTENNA MOD'

\*\*\*\*\*  
\*            ICES STRUDL-II            \*  
\*            THE STRUCTURAL DESIGN LANGUAGE            \*  
\*  
\*            CIVIL ENGINEERING SYSTEMS LABORATORY            \*  
\*            MASSACHUSETTS INSTITUTE OF TECHNOLOGY            \*  
\*            CAMBRIDGE, MASSACHUSETTS            \*  
\*  
\*            08.18.46            30 JUL 80            \*  
\*  
\*            UNIVAC 1100 SERIES EXEC B            \*  
\*            VERSION 2.7            \*  
\*  
\*\*\*\*\*

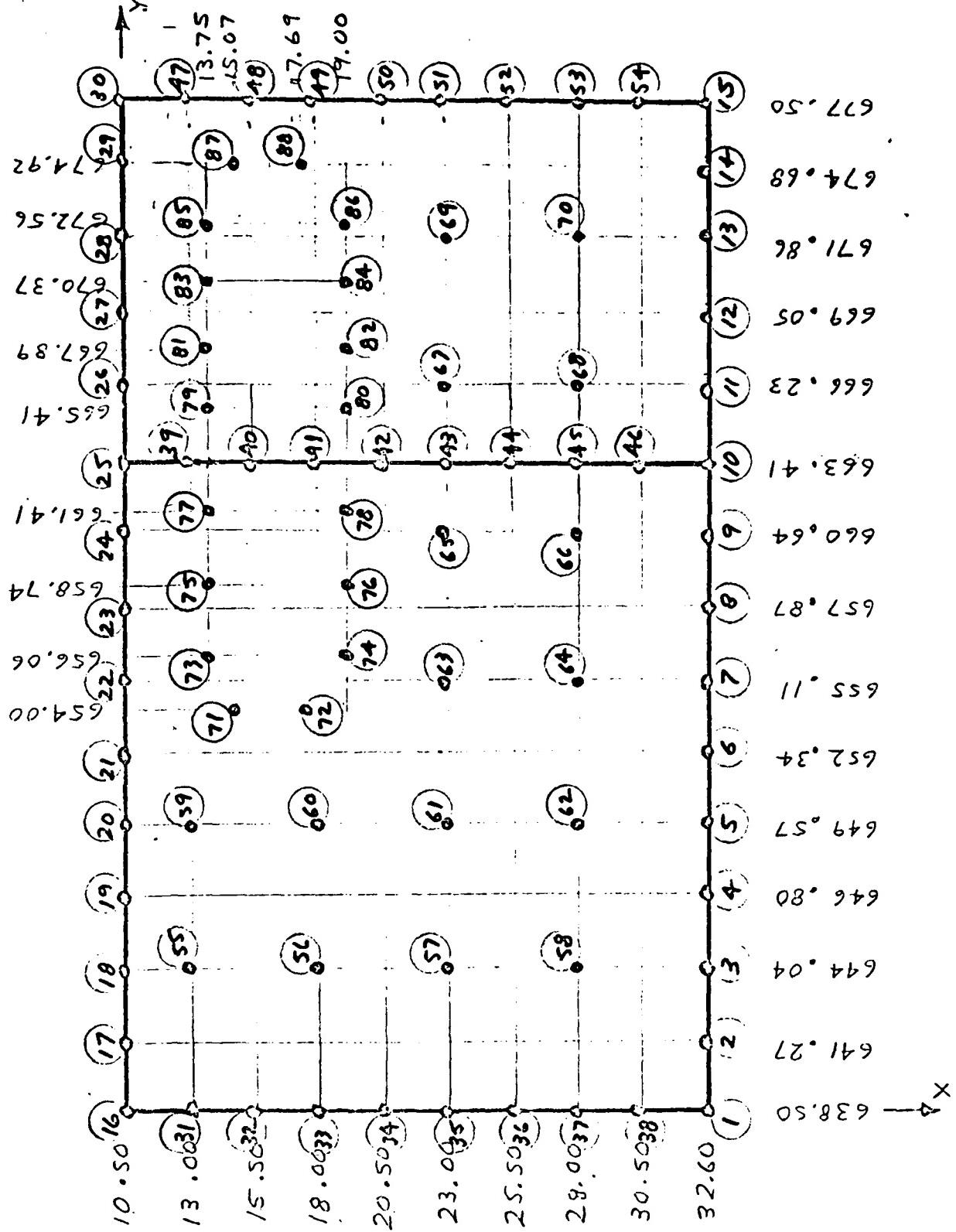
PREPARED BY    MAARTEN VET

NODE    COORDINATES

|    | X     | Y      | Z      |
|----|-------|--------|--------|
| 1  | 32.60 | 638.50 | 289.70 |
| 2  | 32.60 | 641.27 | 290.59 |
| 3  | 32.60 | 644.04 | 291.48 |
| 4  | 32.60 | 646.80 | 293.37 |
| 5  | 32.60 | 649.57 | 293.26 |
| 6  | 32.60 | 652.34 | 294.14 |
| 7  | 32.60 | 655.11 | 295.03 |
| 8  | 32.60 | 657.87 | 295.92 |
| 9  | 32.60 | 660.64 | 296.81 |
| 10 | 32.60 | 663.41 | 297.70 |
| 11 | 32.60 | 666.23 | 298.16 |
| 12 | 32.60 | 669.05 | 298.62 |
| 13 | 32.60 | 671.86 | 299.08 |
| 14 | 32.60 | 674.68 | 299.54 |
| 15 | 32.60 | 677.50 | 300.00 |
| 16 | 10.50 | 638.50 | 295.00 |
| 17 | 10.50 | 641.27 | 295.36 |
| 18 | 10.50 | 644.04 | 295.71 |
| 19 | 10.50 | 646.80 | 296.07 |
| 20 | 10.50 | 649.57 | 296.42 |
| 21 | 10.50 | 652.34 | 296.78 |
| 22 | 10.50 | 655.11 | 297.13 |
| 23 | 10.50 | 657.87 | 297.49 |
| 24 | 10.50 | 660.64 | 297.84 |
| 25 | 10.50 | 663.41 | 298.20 |
| 26 | 10.50 | 666.23 | 298.56 |
| 27 | 10.50 | 669.05 | 298.92 |
| 28 | 10.50 | 671.86 | 299.28 |

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 54     |





|    |       |        |        |
|----|-------|--------|--------|
| 29 | 10.50 | 674.68 | 299.64 |
| 30 | 10.50 | 677.50 | 300.00 |
| 31 | 13.00 | 638.50 | 294.95 |
| 32 | 15.50 | 638.50 | 294.90 |
| 33 | 18.00 | 638.50 | 294.70 |
| 34 | 20.50 | 638.50 | 294.50 |
| 35 | 23.00 | 638.50 | 294.10 |
| 36 | 25.50 | 638.50 | 293.70 |
| 37 | 28.00 | 638.50 | 292.75 |
| 38 | 30.50 | 638.50 | 291.80 |
| 39 | 13.00 | 663.41 | 298.20 |
| 40 | 15.50 | 663.41 | 298.20 |
| 41 | 18.00 | 663.41 | 298.20 |
| 42 | 20.50 | 663.41 | 298.15 |
| 43 | 23.00 | 663.41 | 298.10 |
| 44 | 25.50 | 663.41 | 298.00 |
| 45 | 28.00 | 663.41 | 297.90 |
| 46 | 30.50 | 663.41 | 297.80 |
| 47 | 13.00 | 677.50 | 300.00 |
| 48 | 15.50 | 677.50 | 300.00 |
| 49 | 18.00 | 677.50 | 300.00 |
| 50 | 20.50 | 677.50 | 300.00 |
| 51 | 23.00 | 677.50 | 300.00 |
| 52 | 25.50 | 677.50 | 300.00 |
| 53 | 28.00 | 677.50 | 300.00 |
| 54 | 30.50 | 677.50 | 300.00 |
| 55 | 13.00 | 644.04 | 295.67 |
| 56 | 18.00 | 644.04 | 295.48 |
| 57 | 23.00 | 644.04 | 294.99 |
| 58 | 28.00 | 644.04 | 293.92 |
| 59 | 13.00 | 649.57 | 296.39 |
| 60 | 18.00 | 649.57 | 296.26 |
| 61 | 23.00 | 649.57 | 295.88 |
| 62 | 28.00 | 649.57 | 295.08 |
| 63 | 23.00 | 655.11 | 296.77 |
| 64 | 28.00 | 655.11 | 296.25 |
| 65 | 23.00 | 660.64 | 297.66 |
| 66 | 28.00 | 660.64 | 297.42 |
| 67 | 23.00 | 666.23 | 298.86 |
| 68 | 28.00 | 666.23 | 298.32 |
| 69 | 23.00 | 671.86 | 299.62 |
| 70 | 28.00 | 671.86 | 299.16 |
| 71 | 15.07 | 654.00 | 296.70 |
| 72 | 17.69 | 654.00 | 297.03 |
| 73 | 13.75 | 656.06 | 296.88 |
| 74 | 19.00 | 656.06 | 297.03 |
| 75 | 13.75 | 658.74 | 297.48 |
| 76 | 19.00 | 658.74 | 297.42 |
| 77 | 13.75 | 661.41 | 297.94 |
| 78 | 19.00 | 661.41 | 297.92 |
| 79 | 13.75 | 665.41 | 298.51 |
| 80 | 19.00 | 665.41 | 298.51 |
| 81 | 13.75 | 667.89 | 298.90 |
| 82 | 19.00 | 667.89 | 298.90 |
| 83 | 13.75 | 670.37 | 299.29 |
| 84 | 19.00 | 670.37 | 299.29 |
| 85 | 13.75 | 672.56 | 299.63 |

| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 56     |

|     |       |        |        |         |
|-----|-------|--------|--------|---------|
| 86  | 19.00 | 672.56 | 299.63 |         |
| 87  | 15.07 | 674.92 | 300.00 |         |
| 88  | 17.69 | 674.92 | 300.01 |         |
| 101 | 32.60 | 638.50 | 289.50 | SUPPORT |
| 102 | 32.60 | 641.27 | 290.03 | SUPPORT |
| 103 | 32.60 | 644.04 | 290.98 | SUPPORT |
| 104 | 32.60 | 646.80 | 292.87 | SUPPORT |
| 105 | 32.60 | 649.57 | 292.76 | SUPPORT |
| 106 | 32.60 | 652.34 | 293.64 | SUPPORT |
| 107 | 32.60 | 655.11 | 294.53 | SUPPORT |
| 108 | 32.60 | 657.87 | 295.42 | SUPPORT |
| 109 | 32.60 | 660.64 | 296.31 | SUPPORT |
| 110 | 32.60 | 663.41 | 297.20 | SUPPORT |
| 111 | 32.60 | 666.23 | 297.61 | SUPPORT |
| 112 | 32.60 | 669.05 | 298.12 | SUPPORT |
| 113 | 32.60 | 671.86 | 298.58 | SUPPORT |
| 114 | 32.60 | 674.68 | 299.04 | SUPPORT |
| 115 | 32.60 | 677.50 | 299.50 | SUPPORT |
| 116 | 10.50 | 638.50 | 294.50 | SUPPORT |
| 117 | 10.50 | 641.27 | 294.86 | SUPPORT |
| 118 | 10.50 | 644.04 | 295.21 | SUPPORT |
| 119 | 10.50 | 646.80 | 295.57 | SUPPORT |
| 120 | 10.50 | 649.57 | 295.72 | SUPPORT |
| 121 | 10.50 | 652.34 | 296.28 | SUPPORT |
| 122 | 10.50 | 655.11 | 296.63 | SUPPORT |
| 123 | 10.50 | 657.87 | 296.99 | SUPPORT |
| 124 | 10.50 | 660.64 | 297.34 | SUPPORT |
| 125 | 10.50 | 663.41 | 297.70 | SUPPORT |
| 126 | 10.50 | 666.23 | 298.06 | SUPPORT |
| 127 | 10.50 | 669.05 | 298.42 | SUPPORT |
| 128 | 10.50 | 671.86 | 298.78 | SUPPORT |
| 129 | 10.50 | 674.68 | 299.14 | SUPPORT |
| 130 | 10.50 | 677.50 | 299.50 | SUPPORT |
| 131 | 13.00 | 638.50 | 294.45 | SUPPORT |
| 132 | 15.50 | 638.50 | 294.40 | SUPPORT |
| 133 | 18.00 | 638.50 | 294.20 | SUPPORT |
| 134 | 20.50 | 638.50 | 294.00 | SUPPORT |
| 135 | 23.00 | 638.50 | 293.60 | SUPPORT |
| 136 | 25.50 | 638.50 | 293.20 | SUPPORT |
| 137 | 28.00 | 638.50 | 292.25 | SUPPORT |
| 138 | 30.50 | 638.50 | 291.30 | SUPPORT |
| 139 | 13.00 | 663.41 | 297.70 | SUPPORT |
| 140 | 15.50 | 663.41 | 297.70 | SUPPORT |
| 141 | 18.00 | 663.41 | 297.70 | SUPPORT |
| 142 | 20.50 | 663.41 | 297.65 | SUPPORT |
| 143 | 23.00 | 663.41 | 297.60 | SUPPORT |
| 144 | 25.50 | 663.41 | 297.50 | SUPPORT |

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 57     |

|     |       |        |        |         |
|-----|-------|--------|--------|---------|
| 145 | 28.00 | 663.41 | 297.40 | SUPPORT |
| 146 | 30.50 | 663.41 | 297.30 | SUPPORT |
| 147 | 13.00 | 677.50 | 299.50 | SUPPORT |
| 148 | 15.50 | 677.50 | 299.50 | SUPPORT |
| 149 | 18.00 | 677.50 | 299.50 | SUPPORT |
| 150 | 20.50 | 677.50 | 299.50 | SUPPORT |
| 151 | 23.00 | 677.50 | 299.50 | SUPPORT |
| 152 | 25.50 | 677.50 | 299.50 | SUPPORT |
| 153 | 28.00 | 677.50 | 299.50 | SUPPORT |
| 154 | 30.50 | 677.50 | 299.50 | SUPPORT |

NODE                    RELEASES

|            |       |     |        |   |
|------------|-------|-----|--------|---|
| 101 TO 115 | FORCE | Y   | MOMENT | Y |
| 116 TO 130 | FORCE | X Y | MOMENT | Y |
| 131 TO 138 | FORCE | X Y | MOMENT | X |
| 139 TO 146 | FORCE | X   |        |   |
| 147 TO 154 | FORCE | X Y | MOMENT | X |

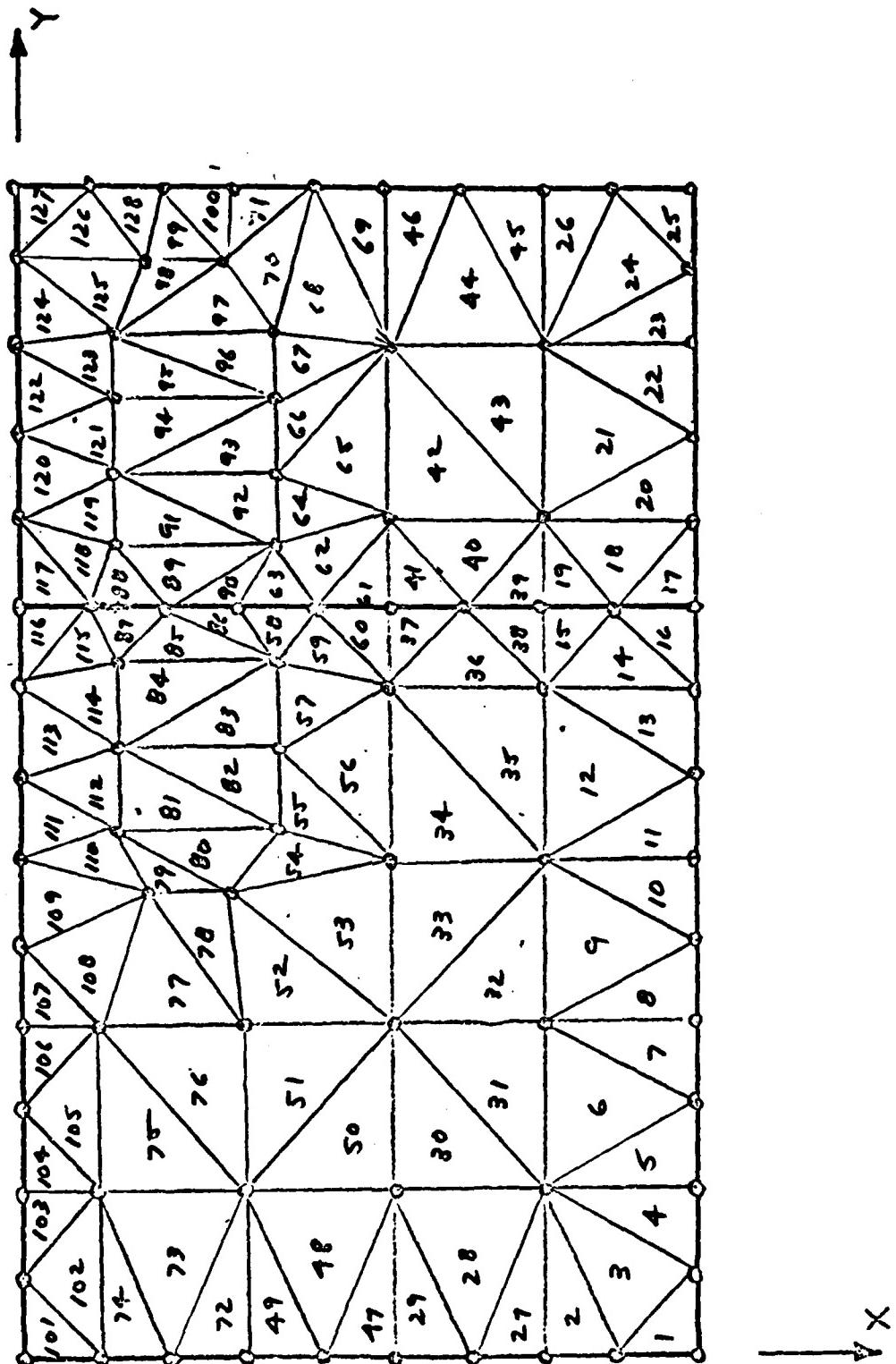
|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 58                |

## TYPE BENDING

## ELEMENT INCIDENCES

|    |    |    |    |    |    |    |    |
|----|----|----|----|----|----|----|----|
| 1  | 2  | 38 | 1  | 52 | 61 | 72 | 60 |
| 2  | 38 | 58 | 37 | 53 | 72 | 61 | 63 |
| 3  | 58 | 38 | 2  | 54 | 72 | 63 | 74 |
| 4  | 58 | 2  | 3  | 55 | 63 | 76 | 74 |
| 5  | 4  | 58 | 3  | 56 | 63 | 65 | 76 |
| 6  | 58 | 4  | 62 | 57 | 76 | 65 | 78 |
| 7  | 62 | 4  | 5  | 58 | 42 | 41 | 78 |
| 8  | 6  | 62 | 5  | 59 | 78 | 65 | 42 |
| 9  | 62 | 6  | 64 | 60 | 42 | 65 | 43 |
| 10 | 64 | 6  | 7  | 61 | 67 | 42 | 43 |
| 11 | 8  | 64 | 7  | 62 | 42 | 67 | 80 |
| 12 | 64 | 8  | 66 | 63 | 41 | 42 | 80 |
| 13 | 66 | 8  | 9  | 64 | 67 | 82 | 80 |
| 14 | 66 | 9  | 46 | 65 | 67 | 69 | 82 |
| 15 | 66 | 46 | 45 | 66 | 82 | 69 | 84 |
| 16 | 46 | 9  | 10 | 67 | 84 | 69 | 86 |
| 17 | 11 | 46 | 10 | 68 | 69 | 50 | 66 |
| 18 | 11 | 68 | 45 | 69 | 50 | 69 | 51 |
| 19 | 46 | 68 | 45 | 70 | 86 | 50 | 88 |
| 20 | 12 | 68 | 11 | 71 | 88 | 50 | 49 |
| 21 | 68 | 12 | 70 | 72 | 56 | 32 | 33 |
| 22 | 70 | 12 | 13 | 73 | 55 | 32 | 56 |
| 23 | 14 | 70 | 13 | 74 | 32 | 55 | 31 |
| 24 | 70 | 14 | 54 | 75 | 56 | 59 | 55 |
| 25 | 54 | 14 | 15 | 76 | 59 | 56 | 60 |
| 26 | 70 | 54 | 53 | 77 | 60 | 71 | 59 |
| 27 | 58 | 36 | 37 | 78 | 71 | 60 | 72 |
| 28 | 57 | 36 | 58 | 79 | 72 | 73 | 71 |
| 29 | 36 | 57 | 35 | 80 | 74 | 73 | 72 |
| 30 | 58 | 61 | 57 | 81 | 74 | 75 | 73 |
| 31 | 61 | 58 | 62 | 82 | 75 | 74 | 76 |
| 32 | 64 | 61 | 62 | 83 | 78 | 75 | 76 |
| 33 | 61 | 64 | 63 | 84 | 75 | 78 | 77 |
| 34 | 64 | 65 | 63 | 85 | 77 | 76 | 48 |
| 35 | 65 | 64 | 66 | 86 | 40 | 78 | 41 |
| 36 | 65 | 66 | 44 | 87 | 40 | 39 | 77 |
| 37 | 65 | 44 | 43 | 88 | 40 | 79 | 39 |
| 38 | 44 | 66 | 45 | 89 | 80 | 79 | 40 |
| 39 | 68 | 44 | 45 | 90 | 80 | 40 | 41 |
| 40 | 68 | 67 | 44 | 91 | 80 | 81 | 79 |
| 41 | 44 | 67 | 43 | 92 | 81 | 80 | 82 |
| 42 | 68 | 69 | 67 | 93 | 84 | 81 | 82 |
| 43 | 69 | 68 | 70 | 94 | 81 | 84 | 53 |
| 44 | 70 | 52 | 69 | 95 | 84 | 85 | 63 |
| 45 | 52 | 70 | 53 | 96 | 85 | 84 | 86 |
| 46 | 69 | 52 | 51 | 97 | 85 | 80 | 88 |
| 47 | 57 | 34 | 35 | 98 | 85 | 88 | 87 |
| 48 | 56 | 34 | 57 |    |    |    |    |
| 49 | 34 | 56 | 53 |    |    |    |    |
| 50 | 61 | 56 | 57 |    |    |    |    |
| 51 | 56 | 61 | 60 |    |    |    |    |

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET<br>59             |



|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET      60                  |

|     |    |    |    |
|-----|----|----|----|
| 99  | 88 | 48 | 87 |
| 100 | 48 | 88 | 49 |
| 101 | 31 | 17 | 16 |
| 102 | 31 | 55 | 17 |
| 103 | 17 | 55 | 18 |
| 104 | 55 | 19 | 18 |
| 105 | 55 | 59 | 19 |
| 106 | 19 | 59 | 20 |
| 107 | 59 | 21 | 20 |
| 108 | 59 | 71 | 21 |
| 109 | 21 | 71 | 22 |
| 110 | 22 | 71 | 73 |
| 111 | 73 | 23 | 22 |
| 112 | 23 | 73 | 75 |
| 113 | 75 | 24 | 23 |
| 114 | 24 | 75 | 77 |
| 115 | 39 | 24 | 77 |
| 116 | 24 | 39 | 25 |
| 117 | 39 | 26 | 25 |
| 118 | 26 | 39 | 79 |
| 119 | 81 | 26 | 79 |
| 120 | 26 | 81 | 27 |
| 121 | 27 | 81 | 83 |
| 122 | 27 | 83 | 28 |
| 123 | 28 | 83 | 85 |
| 124 | 85 | 29 | 28 |
| 125 | 87 | 29 | 85 |
| 126 | 29 | 87 | 47 |
| 127 | 29 | 47 | 30 |
| 128 | 47 | 87 | 48 |

| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 61     |



TYPE SPACE FRAME

MEMBER      INCIDENCES

|     |    |     |     |    |     |
|-----|----|-----|-----|----|-----|
| 201 | 1  | 101 | 228 | 28 | 128 |
| 202 | 2  | 102 | 229 | 29 | 129 |
| 203 | 3  | 103 | 230 | 30 | 130 |
| 204 | 4  | 104 | 231 | 31 | 131 |
| 205 | 5  | 105 | 232 | 32 | 132 |
| 206 | 6  | 106 | 233 | 33 | 133 |
| 207 | 7  | 107 | 234 | 34 | 134 |
| 208 | 8  | 108 | 235 | 35 | 135 |
| 209 | 9  | 109 | 236 | 36 | 136 |
| 210 | 10 | 110 | 237 | 37 | 137 |
| 211 | 11 | 111 | 238 | 38 | 138 |
| 212 | 12 | 112 | 239 | 39 | 139 |
| 213 | 13 | 113 | 240 | 40 | 140 |
| 214 | 14 | 114 | 241 | 41 | 141 |
| 215 | 15 | 115 | 242 | 42 | 142 |
| 216 | 16 | 116 | 243 | 43 | 143 |
| 217 | 17 | 117 | 244 | 44 | 144 |
| 218 | 18 | 118 | 245 | 45 | 145 |
| 219 | 19 | 119 | 246 | 46 | 146 |
| 220 | 20 | 120 | 247 | 47 | 147 |
| 221 | 21 | 121 | 248 | 48 | 148 |
| 222 | 22 | 122 | 249 | 49 | 149 |
| 223 | 23 | 123 | 250 | 50 | 150 |
| 224 | 24 | 124 | 251 | 51 | 151 |
| 225 | 25 | 125 | 252 | 52 | 152 |
| 226 | 26 | 126 | 253 | 53 | 153 |
| 227 | 27 | 127 | 254 | 54 | 154 |

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 62                |



ELEMENT PROPERTIES

1 TO 128 TYPE 'SBCT' THICKNESS .024

MEMBER PROPERTIES

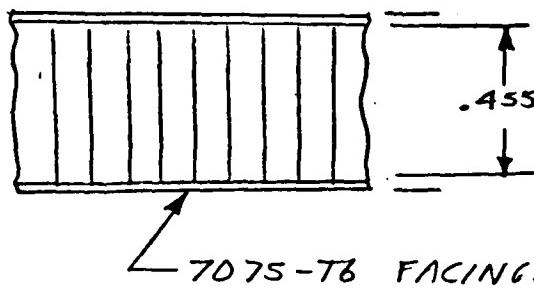
201 TO 254 AX .0228 IX .0002 IY .0001 IZ .0001

CONSTANTS

E 1.14E10 ALL  
G 3.80E6 ALL  
POISSON .33 ALL

E 1.00E7 201 TO 254  
G 3.80E6 201 TO 254  
POISSON .33 201 TO 254

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 63     |



### SHEAR PROPERTIES

$$\text{THICKNESS} = (2)(.012) = .024 \text{ - IN}$$

$$G = 3.8 \times 10^6 \text{ - PSI}$$

### FLEXURAL PROPERTIES

$$EI = (10.0 \times 10^6)(2)(.012 \times 1,000)(.2335)^2 \\ = .01309 \times 10^6 \text{ LB-IN}^2/\text{IN}$$

EQUIVALENT ISOTROPIC PLATE .024-IN. THK

$$E_E \left[ \frac{1}{12} (1,000)(.024)^3 \right] = 1.152 E_E \times 10^{-6}$$

EQUIVALENT FLEXURAL MODULUS

$$E_E = \frac{.01309 \times 10^6}{1.152 \times 10^{-6}} = 1.130 \times 10^{10} \text{ PSI}$$

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET 64                |

LOADING "DRAG"

NODE

LOADS

71.72

FORCE Y +5.05

FORCE Z +39.36

73.74

FORCE Y +5.05

FORCE Z +34.63

75.76

FORCE Y +5.05

FORCE Z +32.38

77.78

FORCE Y +5.05

FORCE Z +30.13

79.80

FORCE Y +5.05

FORCE Z +26.77

81.82

FORCE Y +5.05

FORCE Z +24.69

83.84

FORCE Y +5.05

FORCE Z +22.60

85.86

FORCE Y +5.05

FORCE Z +20.76

87.88

FORCE Y +5.05

FORCE Z -59.32

STIFFNESS ANALYSIS REDUCE BAND ROOT

OUTPUT DECIMAL 3

UNITS KIPS

LIST REACTIONS,DISPLACEMENTS,STRESSES ALL

|           |                      |                         |
|-----------|----------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>134.99 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                  | SHEET 65                |

## 2.0 - AERODYNAMIC CALCULATIONS

### 2.1 - MAXIMUM DYNAMIC PRESSURE

REFERENCE: T.O. 1C-141A-1, FIGURE 5-8.

- MAX. PERMISSIBLE VELOCITY ABOVE 23,000-FT.  
ALTITUDE IS  $M = 0.85$
- MAX PERMISSIBLE VELOCITY BELOW 23,000-FT.  
ALTITUDE IS 380-KNOTS

#### 2.1.1 - AT 23,000-FT ALTITUDE

$$C = 1025 \text{ - FT/SEC}$$

$$\rho = .002378 \left( \frac{P}{P_0} \right) \left( \frac{T_0}{T} \right)$$

$$= (.002378)(.4046)\left(\frac{1}{.8717}\right) = .001143 \text{ LB-SEC}^2/\text{FT}^4$$

$$v = (1025)(.85) = 871 \text{ FT/SEC}$$

$$q_{\infty} = \frac{1}{2} \rho v^2$$

$$= \frac{1}{2} (.001143)(871)^2 = 434 \text{ - LB/FT}^2$$

#### 2.1.2 - AT SEA LEVEL

$$C = 1117 \text{ - FT/SEC}$$

$$\rho = .002378 \text{ LB-SEC}^2/\text{FT}^4$$

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | 66           |

$$v = (380)(1.689) \\ = 642 \text{ FT/SEC} \quad (M = .57)$$

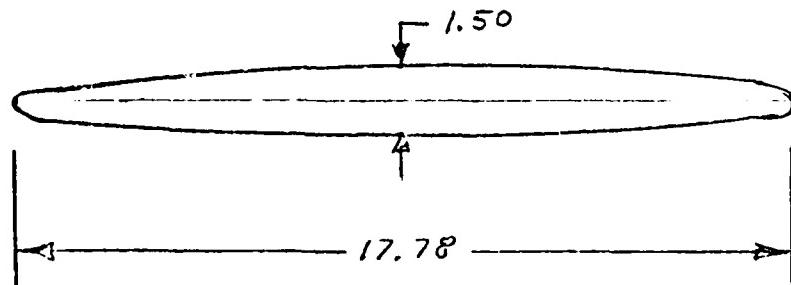
$$\gamma_{\infty} = \frac{1}{2} (.002378)(642)^2 = 190 - 18/\text{FT}^2$$

## 2.2-DRAG & LIFT FORCES

### ASSUMPTIONS:

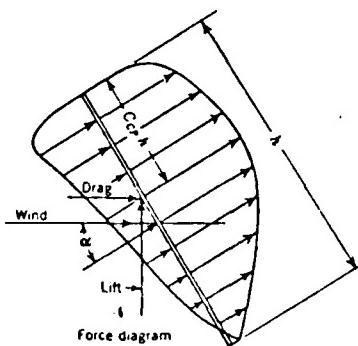
- AS A WORST-CASE, ASSUME THAT THE ANGLE-OF-ATTACK ON THE ANTENNA IS  $10^\circ$ .
- THE SAUCER PORTION OF THE ANTENNA WILL BE TREATED AS A FLAT DISC, RATHER THAN AS AN AIRFOIL.
- THE ENTIRE ANTENNA IS OUTSIDE THE BOUNDARY LAYER. (CONSERVATIVE)

### 2.2.1 - SAUCER



$$A_{REN} = \frac{\pi}{4} \left( \frac{17.78}{12} \right)^2 = 1.724 - \text{FT}^2$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 67                |



(d) INCLINED PLATE

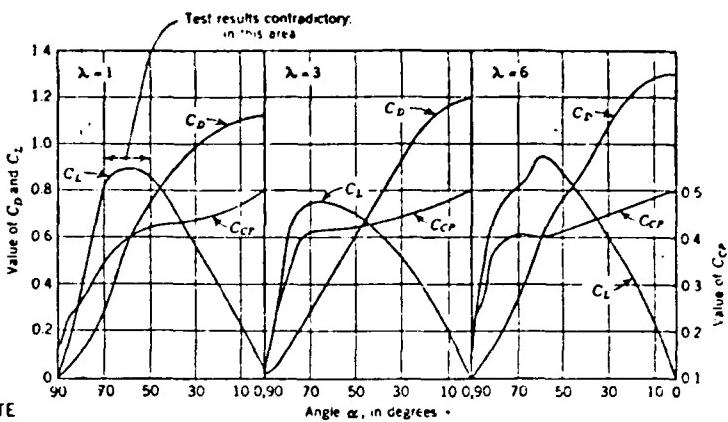


FIG. 5.—WIND PRESSURES ON ELEMENTARY BODIES

(FROM ASCE PAPER 3267)

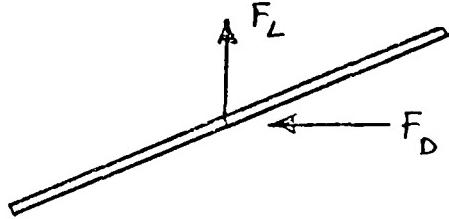
FOR  $\lambda=1$  (A SQUARE PLATE) THE DRAG COEFFICIENT IS ALMOST THE SAME AS FOR A CIRCULAR PLATE OF THE SAME AREA.

FROM THE CURVES ABOVE (FOR  $\lambda=1$ ), AT  $\alpha=80^\circ$ :

$$C_D = .10$$

$$C_L = .40$$

$$C_{CP} = .26$$



(a) AT 23,000-FT ALTITUDE

$$F_D = C_D A \rho_\infty$$

$$= (.10)(1.724)(434) = 74.8 - \text{lb.}$$

$$F_L = C_L A \rho_\infty$$

$$= (.40)(1.721)(434) = 299.3 - \text{lb.}$$

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET 68                |

$$\bar{X} = C_{cD} D = (.26)(17.78) = 4.62 \text{ IN. FROM TOP OF DISC}$$

(b) AT SEA LEVEL

$$F_D = (.10)(1.724)(490) = 84.5 \text{ LB.}$$

$$F_C = (.40)(1.721)(490) = 338.0 \text{ LB.}$$

## 2-2.2 - BAYONET

REFERENCE: DORNE & MARGOLIN ENGR. REPORT NO. 7051.15, "DM C34-3 ANTENNA AERODYNAMIC ANALYSIS".

$$A_{REF} = 1.237 \text{ FT}^2.$$

(a) AT 23,000-FT ALTITUDE

$$C_D = .06683$$

$$F_D = (.06683)(1.237)(490) = 35.9 \text{ LB}$$

(b) AT SEA LEVEL

$$C_D \approx \frac{1}{2}(.00983 + .01133) = .01058$$

$$F_D = (.01058)(1.237)(490) = 6.4 \text{ LB.}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 69                |

2.2.3 - TOTAL ANTENNA

REFERENCE: DORNE & MARCOLIN DRAWING  
261D 1195, "DM C34-3/B UHF  
ANTENNA".

$$Y_{\text{SAUCER}} \approx 10.48 \text{ IN.}$$

$$Y_{\text{BATONET}} \approx 4.86 \text{ IN.}$$

AT 23,000 - FT ALTITUDE

$$F_D = 74.8 + 35.9 = 110.7 \text{ LB}$$

$$F_L = 299.3 \text{ LB}$$

$$\begin{aligned} M &= (74.8)(10.48) + (35.9)(4.86) + (299.3)(4.27) \\ &= 2,236 \text{ IN-LB.} \end{aligned}$$

AT SEA LEVEL

$$F_D = 84.5 + 6.4 = 90.9 \text{ LB.}$$

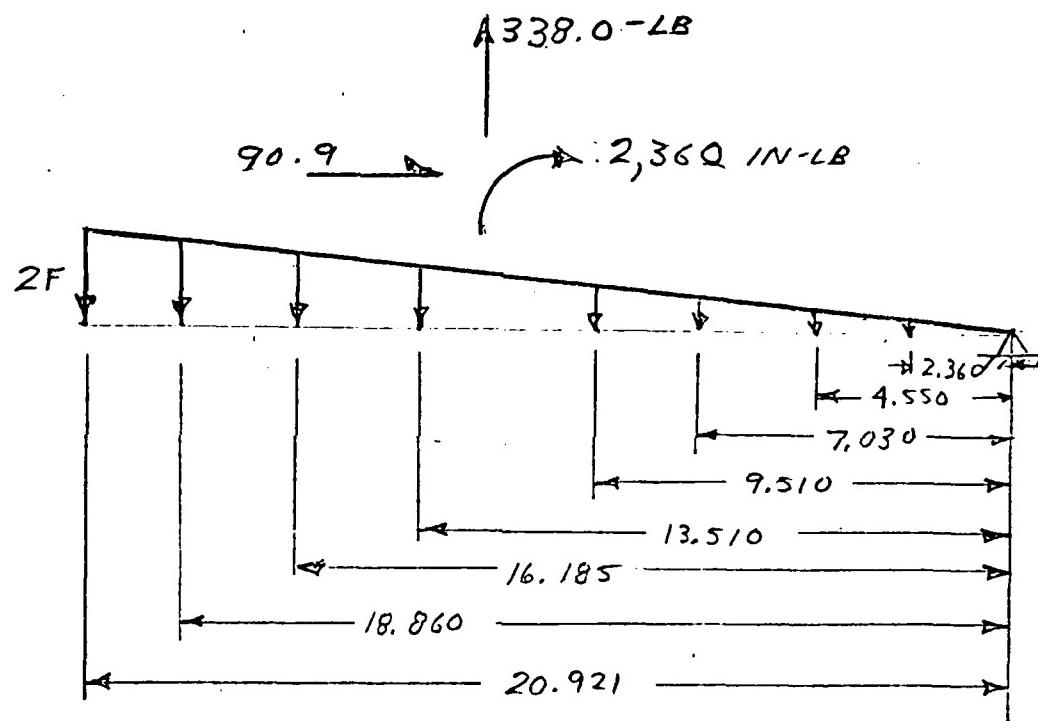
$$F_L = 338.0 \text{ LB}$$

$$\begin{aligned} M &= (84.5)(10.48) + (6.4)(4.86) + (338.0)(4.27) \\ &= 2,360 \text{ IN-LB.} \end{aligned}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 70                |

### 3.0 - FORCES INDUCED INTO THE AIRCRAFT

ASSUMPTION: DUE TO THE STIFFNESS OF THE ANTENNA GUYONET, THE BASE OF THE ANTENNA TENDS TO ROTATE AS A RIGID BODY ABOUT A POINT AT ITS REAR.



#### RESTORING MOMENT

$$M = \frac{2F}{(20.921)} \left[ (20.921)^2 + (18.860)^2 + (16.185)^2 + (13.510)^2 + (9.510)^2 + (7.030)^2 + (4.550)^2 + (2.360)^2 \right]$$

$$= 134.219 F$$

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET 71                |

M. VET  
7-23-50

$$134.219 F = 2,360$$

$$F = 17.58 - \angle 8$$

$$\text{SHEAR PER NODE} = \frac{90.9}{18} = 5.05 - \angle 8$$

$$\text{LIFT PER NODE} = \frac{338.0}{18} = 18.78 - \angle 8$$

$$\text{NODES } 71 \text{ TO } 88 \quad F_y = +5.05 - \angle 8$$

$$\text{NODES } 71, 72 \quad F_z = 17.58 + 18.78 = + 36.36 - \angle 8$$

$$\text{NODES } 73, 74 \quad F_z = (17.58) \left( \frac{18.80}{20.921} \right) + 18.78 = + 34.63 - \angle 8$$

$$\text{NODES } 75, 76 \quad F_z = (17.58) \left( \frac{16.185}{20.921} \right) + 18.78 = + 32.38 - \angle 8$$

$$\text{NODES } 77, 78 \quad F_z = (17.58) \left( \frac{13.510}{20.921} \right) + 18.78 = + 30.13 - \angle 8$$

$$\text{NODES } 79, 80 \quad F_z = (17.58) \left( \frac{9.510}{20.921} \right) + 18.78 = + 26.77 - \angle 8$$

$$\text{NODES } 81, 82 \quad F_z = (17.58) \left( \frac{7.030}{20.921} \right) + 18.78 = + 24.69 - \angle 8$$

$$\text{NODES } 83, 84 \quad F_z = (17.58) \left( \frac{4.550}{20.921} \right) + 18.78 = + 22.60 - \angle 8$$

$$\text{NODES } 85, 86 \quad F_z = (17.58) \left( \frac{2.360}{20.921} \right) + 18.78 = + 20.76 - \angle 8$$

$$\begin{aligned} \text{NODES } 87, 88 \quad F_z &= -\frac{1}{2} [2(36.36 + 34.63 + 32.38 + 30.13 + 26.77 \\ &\quad + 24.69 + 22.60 + 20.76) - 338.0] \\ &= -59.32 - \angle 8 \end{aligned}$$

| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | 72           |

M. VET  
7-30-90

## 4.0 - RESULTS OF THE COMPUTER ANALYSIS

### 4.1 - SHEAR IN THE FACINGS

(ONLY SHEAR STRESS ABOVE 10,000-PSI SHOWN)

| ELEMENT | STRESS (PSI) |
|---------|--------------|
| 37      | 10,637       |
| 54      | 15,467       |
| 55      | 17,000       |
| 80      | 14,251       |
| 86      | 22,191       |
| 96      | 12,582       |
| 115     | 10,941       |

### 4.2 - FLEXURE OF THE HONEYCOMB

$$I = (2)(.012 \times 1.000)(.2335)^2$$

$$C = .2395 \text{ IN.}$$

$$S = \frac{I}{C} = .00546 \text{ IN}^3/\text{IN}$$

BENDING STRESS

$$\sigma = \frac{M}{S} = 183.15 \text{ IN-LB/IN IN ELEMENT 60}$$

$$M_{MAX} = 8.638 \text{ IN-LB/IN IN ELEMENT 60}$$

$$\sigma = (183.15)(8.638) = 1,582 \text{ - PSI}$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 73                |



REVIEWS 115

DATE 07/08/08

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Sheet 74

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DATE 073000 PAGE 40

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- 600

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- 600

-800

610

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610

二十一

## RESULTANT JOINT DISPLACEMENTS • FREE JOINTS

*/-----DISPLACEMENTS-----/-----ROTATIONS-----*

649-2924-001  
Sheet 75.

\*\*\*\*\*  
RESULTS OF LATEST ANALYSIS  
\*\*\*\*\*

PROBLEM - C144-B TITLE - DM C34-B/B UHF ANTENNA MOD

ACTIVE UNITS INCH KIPS RADIAN DEGF SECOND

ACTIVE STRUCTURE TYPE SPACE FRAME

ACTIVE COORDINATE AXES X Y Z

LOADING - DRAG

ELEMENT STRESSES

| ELEMENT | CENTROID                                  | SXX   | SYY   | SXY   | MXY   | MYX  | MYY        | MXZ | MYZ | MZX | MZY |
|---------|---|---|---|---|---|--|------------|-----|-----|-----|-----|
| 1       | CENTROID<br>NODE 2<br>NODE 38<br>NODE 1   | .6217331-03<br>.137658-02<br>.148795-02<br>.192655-02               | .262471-00<br>.6217331-03<br>.137658-02<br>.148795-02<br>.192655-02 | .053405-03<br>.163206-02<br>.141222-02<br>.161444-02                | .635710-00<br>.053405-03<br>-.163206-02<br>-.141222-02<br>-.161444-02 | .741859-03<br>.59519-03<br>.601643-03                  | .237266-00 |     |     |     |     |
| 2       | CENTROID<br>NODE 38<br>NODE 58<br>NODE 37 | .751075-00<br>-.812685-03<br>.158571-03<br>.175365-02<br>.109157-02 | SYY<br>.701199-03<br>-.221218-03<br>.186513-02<br>.113972-02        | .245176-00<br>.701199-03<br>-.221218-03<br>.186513-02<br>.113972-02 | SXY<br>.701199-03<br>-.221218-03<br>.186513-02<br>.113972-02          | .613763-03<br>.901635-03<br>.410668-03                 | .730847-00 |     |     |     |     |
| 3       | CENTROID<br>NODE 58<br>NODE 38<br>NODE 2  | SXX<br>-.14350C-02<br>-.14350C-02<br>-.161368-02<br>.227399-02      | SYY<br>.701199-03<br>-.242U97-02<br>.224453-02<br>.176153-02        | .321717-00<br>.701199-03<br>-.242U97-02<br>.224453-02<br>.176153-02 | SXY<br>.701199-03<br>-.242U97-02<br>.224453-02<br>.176153-02          | .49994344-00<br>.101305-03<br>.151651-03<br>.124423-03 | .339775-00 |     |     |     |     |
| 4       | CENTROID<br>NODE 58<br>NODE 2<br>NODE 3   | SXX<br>-.835524-03<br>-.152851-02<br>.215757-02<br>.9317565-03      | SYY<br>.130919-02<br>-.19991-02<br>-.70227-03<br>-.101683-02        | .563072-00<br>.130919-02<br>-.19991-02<br>-.70227-03<br>-.101683-02 | SXY<br>.130919-02<br>-.19991-02<br>-.70227-03<br>-.101683-02          | .151611-03<br>.153794-03<br>-.630446-03                | .429671-00 |     |     |     |     |
| 5       | CENTROID<br>NODE 4<br>NODE 58             | SXX<br>-.145540-03<br>-.403624-03<br>.170732-02                     | SYY<br>.312196-03<br>-.301938-03<br>-.192624-02                     | .501616-00<br>.312196-03<br>-.301938-03<br>-.192624-02              | SXY<br>.312196-03<br>-.301938-03<br>-.192624-02                       | .810163-03<br>.16127-03                                | .429671-00 |     |     |     |     |

| INVAC 1100 SERIES ICES |      |   |            |      |             |     |            |
|------------------------|------|---|------------|------|-------------|-----|------------|
| DATE                   | NODE | J | SERIES     | ICES | MXY         | MXY | MXY        |
|                        | 4    | - | J27794-03  | MTY  | -630916-03  | MXY | -603423-03 |
| CENTROID               | SXX  | - | 244401+01  | STY  | .363943+00  | SXY | -777001+00 |
|                        | VXX  | . | 105357-03  | VYY  | .620555-04  |     |            |
| NUDE 62                | MXX  | - | 143979-03  | MTY  | .312865-03  | MXY | .179129-03 |
| NUDE 58                | MXX  | - | 128554-02  | MTY  | .14195-02   | MXY | .172858-03 |
| NUDE 4                 | MXX  | . | 349325-03  | MTY  | .753571-03  | MXY | .796570-04 |
| CENTROID               | SXX  | - | 124172+01  | STY  | .156258+00  | SXY | 115361+01  |
|                        | VXX  | . | 121252-02  | VYY  | .157726-03  |     |            |
| NUDE 62                | MXX  | . | 678987-03  | MTY  | .683334-04  | MXY | .137606-03 |
| NUDE 4                 | MXX  | . | 170557-02  | MTY  | .112876-02  | MXY | .356116-03 |
| NUDE 5                 | MXX  | . | 138657-02  | MTY  | .10245-02   | MXY | .44903-03  |
| CENTROID               | SXX  | - | 235751+01  | STY  | .299218+00  | SXY | -101879-01 |
|                        | VXX  | . | 807012-03  | VYY  | .353760-03  |     |            |
| NUDE 6                 | MXX  | . | 735548-04  | MTY  | .493006-03  | MXY | .634516-03 |
| NUDE 62                | MXX  | . | 117700-04  | MTY  | .40622-03   | MXY | .167025-03 |
| NUDE 5                 | MXX  | . | 139393-02  | MTY  | .10421-02   | MXY | .715746-04 |
| CENTROID               | SXX  | - | 272771+01  | STY  | .193408+00  | SXY | -920663+00 |
|                        | VXX  | . | 36448-03   | VYY  | .235112-04  |     |            |
| NUDE 6                 | MXX  | . | 119397-02  | MTY  | .140123-02  | MXY | .224452-03 |
| NUDE 64                | MXX  | . | 19025-02   | MTY  | .293667-02  | MXY | .333612-03 |
| NUDE 62                | MXX  | . | 761262-03  | MTY  | .177719-03  | MXY | .432146-03 |
| CENTROID               | SXX  | - | 169229+01  | STY  | .132931+01  | SXY | -221827-01 |
|                        | VXX  | . | 570946-03  | VYY  | .163485-03  |     |            |
| NUDE 64                | MXX  | . | 330683-02  | MTY  | .344990-02  | MXY | .499078-03 |
| NUDE 6                 | MXX  | . | 795405-03  | MTY  | .783229-03  | MXY | .35463-03  |
| NUDE 7                 | MXX  | . | 593708-03  | MTY  | .309164-03  | MXY | .163995-03 |
| CENTROID               | SXX  | - | 706311+00  | STY  | .261717401  | SXY | -247128601 |
|                        | VXX  | . | 194862-03  | VYY  | .29070-03   |     |            |
| NUDE 6                 | MXX  | . | 157571-03  | MTY  | .563273-03  | MXY | .463350-03 |
| NUDE 64                | MXX  | . | 202026-02  | MTY  | .352824-02  | MXY | .46673-03  |
| NUDE 7                 | MXX  | . | 814734-03  | MTY  | .201556-03  | MXY | .260041-03 |
| CENTROID               | SXX  | - | 522011+00  | STY  | .169401+01  | SXY | -197591+01 |
|                        | VXX  | . | 281452-03  | VYY  | .132828-03  |     |            |
| NUDE 66                | MXX  | . | 1626301-02 | MTY  | .94021-03   | MXY | .699108-04 |
| NUDE 64                | MXX  | . | 202284-02  | MTY  | .1586926-02 | MXY | .616369-03 |
| NUDE 8                 | MXX  | . | 814734-03  | MTY  | .3080822-03 | MXY | .362129-03 |
| CENTROID               | SXX  | - | 269201+01  | STY  | .386173+01  | SXY | -128430+01 |
|                        | VXX  | . | 807661-04  | VYY  | .177216-03  |     |            |
| NUDE 66                | MXX  | . | 684558-03  | MTY  | .697208-03  | MXY | .121868-03 |
| NUDE 6                 | MXX  | . | 160747-03  | MTY  | .836187-03  | MXY | .516352-03 |
| NUDE 9                 | MXX  | . | 375142-03  | MTY  | .487352-03  | MXY | .447774-03 |

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|    |          |            |  |                                 |  |                          |   |
|----|----------|------------|--|---------------------------------|--|--------------------------|---|
| 14 | CENTROID | SXX<br>VXX | *11081+02<br>"32562+04<br>"104871-03<br>"25805-03<br>.263547-04        | SYY<br>VYY<br>MYY<br>MYY<br>MYY | *2222993+01<br>"106873-03<br>"254046-03<br>.459735-03                  | SXY<br>MXY<br>MXY<br>MXY | *3633556+01<br>"233827-03<br>"117046-04<br>.367269-04 |
| 15 | CENTROID | SXX<br>VXX | "762859+00<br>"554945-05<br>"366911-06<br>"146233-02<br>.132428-02     | SYY<br>VYY<br>MYY<br>MYY<br>MYY | "113345+00<br>"512135-03<br>"652525-03<br>"204221-02<br>.443856-03     | SXY<br>MXY<br>MXY<br>MXY | *104997+02<br>"659077-03<br>"234019-04<br>.258356-04  |
| 16 | CENTROID | SXX<br>VXX | *671467+00<br>"-53126+03<br>"125780-02<br>"105281-02<br>"-297532-03    | SYY<br>VYY<br>MYY<br>MYY<br>MYY | *194667+01<br>"-173588-03<br>"140116-02<br>"684535-03<br>"-394169-03   | SXY<br>MXY<br>MXY<br>MXY | *314887+01<br>"615130-04<br>"140354-03<br>.1663556-04 |
| 17 | CENTROID | SXX<br>VXX | "666856+01<br>"-67155-03<br>"950575-05<br>"130529-02<br>"-377493-03    | SYY<br>VYY<br>MYY<br>MYY<br>MYY | *103461+02<br>"535670-03<br>"631016-03<br>"974775-03<br>"-570690-03    | SXY<br>MXY<br>MXY<br>MXY | *801168+01<br>"245963-03<br>"225673-03<br>.193805-03  |
| 18 | CENTROID | SXX<br>VXX | "240497+01<br>"506246-03<br>"912068-03<br>"368230-05<br>"-521485-05    | SYY<br>VYY<br>MYY<br>MYY<br>MYY | *802927-01<br>"472722-03<br>"101653-02<br>"-135497-03<br>"726390-04    | SXY<br>MXY<br>MXY<br>MXY | *429220+01<br>"778634-04<br>"761394-04<br>.103578-04  |
| 19 | CENTROID | SXX<br>VXX | "842531+01<br>"386553-05<br>"964277-03<br>"668503-03<br>"-109546-02    | SYY<br>VYY<br>MYY<br>MYY<br>MYY | *260420-01<br>"250256-03<br>"778756-03<br>"341260-03<br>"-132719-02    | SXY<br>MXY<br>MXY<br>MXY | *206150+01<br>"168996-03<br>"18491-04<br>.103578-04   |
| 20 | CENTROID | SAX<br>VAX | "226795+01<br>"-678653-04<br>"-366296-05<br>"-709340-04<br>".626834-03 | SYY<br>VYY<br>MYY<br>MYY<br>MYY | *795087-01<br>"-331746-03<br>"-235792-03<br>"-912037-04<br>".710976-05 | SXY<br>MXY<br>MXY<br>MXY | *882568+00<br>"133307-04<br>"424429-04<br>.432939-04  |
| 21 | CENTROID | SAX<br>VAX | "998458+00<br>"98067-05<br>".167584-03<br>"21922-03<br>.276726-03      | SYY<br>VYY<br>MYY<br>MYY<br>MYY | *264125-01<br>"461325-05<br>"735685-04<br>"202029-03<br>".258502-03    | SXY<br>MXY<br>MXY<br>MXY | *287136+01<br>"00644-06<br>"22024-04<br>.350649-05    |

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|    |          |            |                          |            |                            |     |                             |
|----|----------|------------|--------------------------|------------|----------------------------|-----|-----------------------------|
| 22 | CENTROID | SXX<br>VXX | -265994+00<br>.567425+04 | SYY<br>VYY | .570084+01<br>.149070+03   | SKY | -.9355664+00<br>-.316151+04 |
|    | NUDE 70  | MXX        | -.103895+03              | MYY        | -.221134+03                | MXY | -.523517+04                 |
|    | NUDE 12  | MXX        | -.149877+03              | MYY        | -.249622+03                | MXY | -.179317+04                 |
|    | NUDE 13  | MXX        | -.347131+03              | MYY        | .222259+03                 | MXY | -.36906+04                  |
| 23 | CENTROID | SXX<br>VXX | -111914+01<br>.442615+04 | SYY<br>VYY | .363481+01<br>-.316151+04  | SKY | -.152115+01                 |
|    | NUOC 14  | MXX        | .142021+03               | MYY        | .845006+04                 | MXY | +.526019+04                 |
|    | NUDE 70  | MXX        | -.18374+04               | MYY        | -.14504+03                 | MXY | +.466690+04                 |
|    | NUDE 13  | MXX        | .352345+03               | MYY        | .17192+03                  | MXY | -.624937+04                 |
| 24 | CENTROID | SXX<br>VXX | -255037+00<br>.430701+04 | SYY<br>VYY | -.335602+00<br>-.447655+04 | SKY | -.234219+01                 |
|    | NUDE 59  | MXX        | .223333+04               | MYY        | .878426+04                 | MXY | -.926560+04                 |
|    | NUDE 70  | MXX        | .128009+04               | MYY        | -.58135+04                 | MXY | -.542860+04                 |
|    | NUDE 14  | MXX        | .103416+03               | MYY        | -.197093+03                | MXY | -.555532+04                 |
| 25 | CENTROID | SXX<br>VXX | .693621+00<br>.100513+02 | SYY<br>VYY | .160265+01<br>-.202389+03  | SKY | -.123206+01                 |
|    | NUOC 54  | MXX        | -.923377+03              | MYY        | .92624+03                  | MXY | -.134666+03                 |
|    | NUDE 14  | MXX        | -.00876+03               | MYY        | .920309+04                 | MXY | -.31526+04                  |
|    | NUDE 15  | MXX        | .1222552+02              | MYY        | .354361+03                 | MXY | -.515701+04                 |
| 26 | CENTROID | SXX<br>VXX | .233051+01<br>.244356+04 | SYY<br>VYY | -.173397+01<br>-.988668+05 | SKY | -.120653+01                 |
|    | NUDE 70  | MXX        | -.925119+04              | MYY        | .167962+04                 | MXY | -.734359+05                 |
|    | NUDE 54  | MXX        | -.952453+04              | MYY        | -.59850+04                 | MXY | -.104218+04                 |
|    | NUDE 53  | MXX        | -.280466+04              | MYY        | -.317949+04                | MXY | -.868269+05                 |
| 27 | CENTROID | SXX<br>VXX | -217322+01<br>.355762+03 | SYY<br>VYY | .777675+00<br>-.26890+03   | SKY | .268857+01                  |
|    | NUDE 56  | MXX        | -.156164+02              | MYY        | .150782+02                 | MXY | -.392126+04                 |
|    | NUDE 56  | MXX        | -.258220+03              | MYY        | -.452207+03                | MXY | -.164403+04                 |
|    | NUDE 57  | MXX        | -.878791+03              | MYY        | .533604+03                 | MXY | -.191779+03                 |
| 28 | CENTROID | SXX<br>VXX | -260616+01<br>.311133+03 | SYY<br>VYY | .130400+01<br>.483703+03   | SKY | .137859+01                  |
|    | NUOC 57  | MXX        | .140181+02               | MYY        | .109445+02                 | MXY | -.124456+03                 |
|    | NUDE 56  | MXX        | .999934+03               | MYY        | .599610+03                 | MXY | -.25649+03                  |
|    | NUDE 56  | MXX        | -.103794+02              | MYY        | .232493+02                 | MXY | -.136684+03                 |
| 29 | CENTROID | SXX<br>VXX | -230402+01<br>.234352+03 | SYY<br>VYY | .091993+00<br>-.43043+03   | SKY | .141279+01                  |
|    | NUDE 36  | MXX        | .913761+03               | MYY        | .268229+04                 | MXY | -.122993+03                 |
|    | NUDE 37  | MXX        | .511793+03               | MYY        | -.0902+03                  | MXY | -.365777+04                 |
|    | NUDE 37  | MXX        | .576031+03               | MYY        | -.775983+03                | MXY | -.434077+04                 |

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|    |          |     |              |     |              |     |             |
|----|----------|-----|--------------|-----|--------------|-----|-------------|
| 30 | CENTROID | SXX | -0.556432-01 | SYY | .303163+00   | SKY | .0000594400 |
|    | NODE 56  | VXX | -0.489220-03 | VYY | .326892-03   |     |             |
|    | NODE 61  | MXX | -0.211579-02 | MYY | -0.235663-02 | MXY | .106671-03  |
|    | NODE 57  | MXX | -0.112420-02 | MYY | -0.126532-02 | MXY | .126253-03  |
|    |          | MXX | .906331-03   | MYY | .843583-03   | MXY | .102130-03  |

|    |          |     |              |     |             |     |             |
|----|----------|-----|--------------|-----|-------------|-----|-------------|
| 31 | CENTROID | SXX | -0.198644+01 | SYY | .0128900+00 | SKY | -.124390+01 |
|    | NODE 61  | VXX | .242657-03   | VYY | .111212-03  |     |             |
|    | NODE 58  | MXX | -.784353-03  | MYY | -.961447-03 | MXY | .159486-03  |
|    | NODE 62  | MXX | -.130350-02  | MYY | -.134724-02 | MXY | .146001-03  |
|    |          | MXX | .2,6934-03   | MYY | .161001-03  | MXY | .292391-03  |

|    |          |     |             |     |             |     |             |
|----|----------|-----|-------------|-----|-------------|-----|-------------|
| 32 | CENTROID | SXX | -.358474+01 | SYY | .174516+00  | SKY | -.182158+01 |
|    | NODE 64  | VXX | -.125224-03 | VYY | .0395068-03 |     |             |
|    | NODE 61  | MXX | -.155589-02 | MYY | -.222375-02 | MXY | .148026-03  |
|    | NODE 62  | MXX | -.982799-03 | MYY | -.121113-02 | MXY | .575115-04  |
|    |          | MXX | .643339-03  | MYY | .372705-03  | MXY | .420100-03  |

|    |          |     |             |     |             |     |             |
|----|----------|-----|-------------|-----|-------------|-----|-------------|
| 33 | CENTROID | SXX | -.102592+01 | SYY | .103467+02  | SKY | -.145696+01 |
|    | NODE 61  | VXX | -.111124-02 | VYY | .121131-02  |     |             |
|    | NODE 64  | MXX | -.214355-02 | MYY | -.191923-02 | MXY | .947162-04  |
|    | NODE 63  | MXX | -.448487-02 | MYY | -.466109-02 | MXY | .636664-04  |
|    |          | MXX | .401021-02  | MYY | .340451-02  | MXY | .6697306-03 |

|    |          |     |             |     |             |     |             |
|----|----------|-----|-------------|-----|-------------|-----|-------------|
| 34 | CENTROID | SXX | .150654+02  | SYY | .196405+01  | SKY | .491296+01  |
|    | NODE 64  | VXX | *.105938-02 | VYY | .123103-02  |     |             |
|    | NODE 65  | MXX | -.405111-02 | MYY | -.401376-02 | MXY | .312114-03  |
|    | NODE 63  | MXX | -.261126-02 | MYY | -.296339-02 | MXY | .260052-03  |
|    |          | MXX | .346036-02  | MYY | .233333-02  | MXY | .1118014-02 |

|    |          |     |             |     |             |     |             |
|----|----------|-----|-------------|-----|-------------|-----|-------------|
| 35 | CENTROID | SXX | *.103862+02 | SYY | *.205789+01 | SKY | .212069+01  |
|    | NODE 65  | VXX | -.886574-03 | VYY | .691168-03  |     |             |
|    | NODE 64  | MXX | -.569887-02 | MYY | -.911494-02 | MXY | .393029-03  |
|    | NODE 66  | MXX | -.193924-02 | MYY | -.122010-02 | MXY | .142136-03  |
|    |          | MXX | -.164883-02 | MYY | .135255-02  | MXY | .3337234-03 |

|    |          |     |             |     |             |     |              |
|----|----------|-----|-------------|-----|-------------|-----|--------------|
| 36 | CENTROID | SXX | .662061+01  | SYY | .126710+02  | SKY | -.2866114+00 |
|    | NODE 65  | VXX | -.137148-02 | VYY | .111997-02  |     |              |
|    | NODE 66  | MXX | -.4,3745-02 | MYY | .502850-02  | MXY | .644366-03   |
|    | NODE 44  | MXX | -.726761-03 | MYY | .121174-02  | MXY | .582019-03   |
|    |          | MXX | -.3,2827-02 | MYY | -.203114-02 | MXY | .149354-02   |

|    |          |     |             |     |             |     |             |
|----|----------|-----|-------------|-----|-------------|-----|-------------|
| 37 | CENTROID | SXX | -.166170+02 | SYY | *.223591+01 | SKY | .106566+02  |
|    | NODE 65  | VXX | -.186300-03 | VYY | *.442021-02 |     |             |
|    | NODE 44  | MXX | -.0,5218-02 | MYY | .842668-02  | MXY | .392156-03  |
|    | NODE 43  | MXX | -.589080-03 | MYY | .61413-03   | MXY | .43003-03   |
|    |          | MXX | -.355070-02 | MYY | .694946-02  | MXY | .1341442-02 |

|    |          |     |             |     |             |     |            |
|----|----------|-----|-------------|-----|-------------|-----|------------|
| 38 | CENTROID | SXX | -.100759+02 | SYY | *.129119+01 | SKY | .812703+01 |
|----|----------|-----|-------------|-----|-------------|-----|------------|

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|---------|-----|--------------|-----|--------------|
| NUDE 44 | VXX | " 4111781-03 | VYY | " 3122216-03 |
|         | XXX | " 2,7664-03  | MTY | " 620271-03  |
| NUDE 66 | XXX | " 139700-03  | MTY | " 71350-03   |
| NUDE 45 | XXX | " 3,3177-03  | MTY | " 733266-03  |
|         |     | " 01,6589-02 | MTY |              |

|          |     |               |     |              |
|----------|-----|---------------|-----|--------------|
| CENTROID | SXX | " 3159305+02  | SYY | " 276218+00  |
|          | VXX | " 0,115452-03 | VYY | " 0355914+00 |
| NUDE 68  | XXX | " 132902-02   | MTY | " 592731-03  |
| NUDE 44  | XXX | " 308578-03   | MTY | " 111444-02  |
| NUDE 45  | XXX | " 0,9,2690-03 | MTY | " 163698-02  |
|          |     |               |     | " 558867-03  |

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|----------|-----|---------------|-----|-------------|
| CENTROID | SXX | " 898569-01   | SYY | " 597004+01 |
|          | VXX | " 0,222822-03 | VYY | " 779285-03 |
| NUDE 68  | XXX | " 1,9752-02   | MTY | " 594092-03 |
| NUDE 67  | XXX | " 9,5172-03   | MTY | " 134735-03 |
| NUDE 44  | XXX | " 2,5313-02   | MTY | " 522747-02 |
|          |     |               |     | " 373860-03 |

|          |     |               |     |             |
|----------|-----|---------------|-----|-------------|
| CENTROID | SXX | " 222567+02   | SYY | " 537627+00 |
|          | VXX | " 0,875673-03 | VYY | " 270168-02 |
| NUDE 44  | XXX | " 3,55857-03  | MTY | " 942285-03 |
| NUDE 67  | XXX | " 440116-02   | MTY | " 335838-02 |
| NUDE 43  | XXX | " 257425-02   | MTY | " 645653-02 |
|          |     |               |     | " 656513-03 |

|          |     |               |     |             |
|----------|-----|---------------|-----|-------------|
| CENTROID | SXX | " 316055+00   | SYY | " 102169+01 |
|          | VXX | " 0,219258-03 | VYY | " 140102-03 |
| NUDE 68  | XXX | " 1,04922-03  | MTY | " 590347-03 |
| NUDE 59  | XXX | " 687642-03   | MTY | " 554903-03 |
| NUDE 67  | XXX | " 770667-03   | MTY | " 788494-03 |
|          |     |               |     | " 309926-03 |

|          |     |               |     |             |
|----------|-----|---------------|-----|-------------|
| CENTROID | SXX | " 1911667-01  | SYY | " 672272+00 |
|          | VXX | " 2,244153-04 | VYY | " 356534-04 |
| NUDE 69  | XXX | " 365127-04   | MTY | " 295305-04 |
| NUDE 68  | XXX | " 111879-03   | MTY | " 188148-03 |
| NUDE 70  | XXX | " 0,775769-04 | MTY | " 505863-04 |
|          |     |               |     | " 519175-04 |

|          |     |              |     |               |
|----------|-----|--------------|-----|---------------|
| CENTROID | SXX | " 174936+01  | SYY | " 998003+00   |
|          | VXX | " 4,66142-04 | VYY | " 4,661091-04 |
| NUDE 69  | XXX | " 343720-04  | MTY | " 217265-03   |
| NUDE 52  | XXX | " 693298-04  | MTY | " 965430-04   |
| NUDE 69  | XXX | " 379229-03  | MTY | " 252326-03   |
|          |     |              |     | " 352759-04   |

|          |     |               |     |              |
|----------|-----|---------------|-----|--------------|
| CENTROID | SXX | " 275042+01   | SYY | " 159540+01  |
|          | VXX | " 0,158096-03 | VYY | " 600627-04  |
| NUDE 52  | XXX | " 1,77648-03  | MTY | " 4,17632-04 |
| NUDE 70  | XXX | " 642505-04   | MTY | " 184135-04  |
| NUDE 53  | XXX | " 1,61286-03  | MTY | " 151255-03  |
|          |     |               |     | " 317776-04  |

|          |     |               |     |             |
|----------|-----|---------------|-----|-------------|
| CENTROID | SXX | " 167634+01   | SYY | " 768427-01 |
|          | VXX | " 1,508686-03 | VYY | " 370319-04 |

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|    |          |            |                                   |                                    |  |  |
|----|----------|------------|-----------------------------------|------------------------------------|--|--|
| 47 | CENTROID | SXX<br>VXX | *.270344+01 SYT<br>.323503-03 VYY | *.4072256+00 SYT<br>.149273-03 MYY | .533520-03 MXY<br>.750429-04 MXZ<br>.273947-03 MYY | .114713-03<br>-.935018-06<br>-.578243-04               |
| 48 | CENTROID | SXX<br>VXX | *.658869-00 SYT<br>.271440-04 VYY | *.213973-05 SYT<br>.766352-05 MYY  | .163658-03 MXY<br>.130225-03 MXZ<br>.582204-03 MYY | .553667-03<br>-.281605-04<br>.723532-04                |
| 49 | CENTROID | SXX<br>VXX | *.333369 01 SYT<br>.347535 03 VYY | *.186121+01 SYT<br>.379410-03 MYY  | .4072256+00 SYT<br>.390142-03 MYY                  | .435486-01<br>-.31974-04<br>-.550194-04                |
| 50 | CENTROID | SXX<br>VXX | *.609709 00 SYT<br>.106445-03 VYY | *.274693+00 SYT<br>.344924-03 MYY  | .478619-03 MXY<br>.454411-03 MXZ<br>.488986-03 MYY | .236743+01<br>-.276071-04<br>-.419421-04<br>.691367-04 |
| 51 | CENTROID | SXX<br>VXX | *.691730-00 SYT<br>.437061-03 VYY | *.121212+01 SYT<br>.244518-03 MYY  | .122311-02 MXY<br>.149211-02 MXZ<br>.595772-03 MYY | .374237+00<br>-.175647-03<br>-.106000-03<br>.867666-04 |
| 52 | CENTROID | SXX<br>VXX | *.63994-01 SYT<br>.548316-03 VYY  | *.220179+01 SYT<br>.363115-03 MYY  | .333227-04 MXY<br>.312336-03 MXZ<br>.149903-02 MYY | .235992+00<br>-.162565-03<br>-.34017-03<br>.506293-03  |
| 53 | CENTROID | SXX<br>VXX | *.179058+02 SYT<br>.727018-03 VYY | *.1227265+00 SYT<br>.200354-02 MYY | .155376-02 MXY<br>.142204-02 MXZ<br>.234053-02 MYY | .486641+02<br>-.235067-03<br>-.15995-03<br>-.428044-03 |
| 54 | CENTROID | SXX<br>VXX | *.111242+02 SYT<br>.605366-03 VYY | *.126346+02 SYT<br>.579064-03 MYY  | .102551-02 MXY<br>.142071-02 MXZ                   | .154671+02<br>-.210865-03                              |

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NUDE 63 MAX \*201017-02 MYY \*284541-02 MYY \*460026-04  
NUUE 74 MAX \*166643-02 MYY \*149125-02 MYY \*442900-04

CENTROID SXX \*183479-02 SYV \*316216+01 SXV \*170003+02

NUDE 63 MAX \*195532-02 VYV \*143931-02 MYY \*561414-02 MYY \*260501-03  
NUOC 76 MAX \*5248671-02 MYY \*349151-02 MYY \*202125-03  
NUDE 74 MAX \*320553-02 MYY \*215508-02 MYY \*870176-05

CENTROID SXX \*639408+01 SYV \*121929+02 SXV \*614694+01

NUOC 63 MAX \*838935-03 VYV \*513677-03 MYY \*365287-02 MYY \*333852-04  
NUOC 65 MAX \*370039-02 MYY \*408722-02 MYY \*545294-02 MYY \*902618-04  
NUDE 76 MAX \*430956-03 MYY \*234167-03 MYY \*105336-03

CENTROID SXX \*224326+01 SYV \*111444+01 SXV \*795929+01

NUDE 76 MAX \*120006-03 VYV \*310298-03 MYY \*238226-02 MYY \*468087-03  
NUOC 65 MAX \*165435-02 MYY \*401202-02 MYY \*48537-02 MYY \*325913-03  
NUDE 76 MAX \*430167-02 MYY \*236802-03 MYY \*182405-02 MYY \*801651-03

CENTROID SXX \*2566835+02 SYV \*114464+02 SXV \*752246+01

NUDE 78 MAX \*112771-02 VYV \*263364-02 MYY \*380293-02 MYY \*560899-04  
NUUE 42 MAX \*536158-02 MYY \*40167-02 MYY \*626049-03 MYY \*16934-03  
NUDE 78 MAX \*430167-02 MYY \*236802-03 MYY \*616613-02 MYY \*443758-03

CENTROID SXX \*106530+02 SYV \*103035+02 SXV \*165958+01

NUDE 78 MAX \*199769-02 VYV \*150361-02 MYY \*263862-02 MYY \*106724-02  
NUOC 65 MAX \*47605-02 MYY \*397113-02 MYY \*35001-02 MYY \*309680-03  
NUDE 42 MAX \*317079-02 MYY \*286470-02 MYY \*315683-02 MYY \*438561-03

CENTROID SXX \*198129+02 SYV \*483091+01 SXV \*631601+01

NUOC 42 MAX \*110833-02 VYV \*16218-02 MYY \*109238-02 MYY \*879413-04  
NUOC 65 MAX \*283552-02 MYY \*633784-02 MYY \*816659-02 MYY \*413308-03  
NUOC 43 MAX \*286470-02 MYY \*743025-02 MYY \*662086-03 MYY \*977507-03

CENTROID SXX \*170692+02 SYV \*225181-01 SXV \*907709+01

NUDE 67 MAX \*436012-04 VYV \*277003-02 MYY \*339117-02 MYY \*521299-04  
NUUE 42 MAX \*461193-02 MYY \*618659-02 MYY \*456359-02 MYY \*976716-04  
NUDE 43 MAX \*143449-02 MYY \*265506-02 MYY \*690346-02 MYY \*151210-03

CENTROID SXX \*476020+01 SYV \*106658-02 SXV \*665912+00

NUDE 67 MAX \*240295-02 VYV \*134879-02 MYY \*664501-03 MYY \*412415-03  
NUUE 80 MAX \*39252-02 MYY \*216710-02 MYY \*977507-03

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NODE 42

MXX -.362638-02 MYY -.493652-02 MXY .921126-03

CENTROID SXX -.340877+02 SYY +.195725+01 SXY -.544736+01

VXX MXX .162000-02 VYY .202797-02 MYY -.124980-02 MXY .153577-03

NODE 42 MXX .144536-02 MYY -.114571-02 MYY -.179685-02 MXY .440833-03

NODE 40 MXX .462498-02 MYY -.114571-02 MYY -.633597-02 MXY .769593-03

NODE 41 MXX -.114571-02 MYY -.633597-02 MXY .769593-03

CENTROID SXX -.490095+01 SYY +.315699+01 SXY .430004+01

NODE 67 VXX MXX -.149554-03 VYY +.195019-02 MYY .543739-03 MXY .254649-03

NODE 62 MXX .420432-03 MYY .424461-03 MXY .230084-03

NODE 80 MXX -.647634-04 MYY .424461-03 MXY .223569-03

MXX -.344440-03 MYY -.599362-04 MXY .223569-03

CENTROID SXX -.575114+01 SYY +.191380+01 SXY -.343675+01

NODE 69 VXX MXX .302937-03 VYY +.598820-04 MYY .298887-03 MXY .191247-03

NODE 82 MXX -.670401-03 MYY -.266380-03 MXY .243185-03

NODE 67 MXX -.558226-03 MYY .121059-02 MXY .232325-03

CENTROID SXX -.419568+01 SYY +.695226+01 SXY +.266713+00

NODE 82 VXX MXX -.705358-03 VYY +.149928-02 MYY .112677-02 MXY .125777-03

NODE 69 MXX -.160151-02 MYY -.259267-03 MXY .269200-03

NODE 84 MXX .630447-03 MYY .248660-02 MXY .348108-03

CENTROID SXX .468372+01 SYY +.5355023+01 SXY +.545202+01

NODE 84 VXX MXX .257683-03 VYY +.168837-02 MYY .252321-02 MXY .235603-03

NODE 69 MXX .222635-02 MYY -.705984-04 MXY .174272-03

NODE 86 MXX -.0960-0-03 MYY -.133503-02 MXY .653592-04

CENTROID SXX .807033+01 SYY +.340696+01 SXY +.290492+01

NODE 69 VXX MXX .141309-03 VYY +.124346-03 MYY .557037-04 MXY .161379-03

NODE 30 MXX .149735-03 MYY .250520-03 MXY .725569-04

NODE 86 MXX .525539-03 MYY -.959524-03 MXY .152726-03

CENTROID SXX .100071+01 SYY +.146104+00 SXY .774604+00

NODE 30 VXX MXX -.34609-03 MYY -.983226-03 MXY .456226-04

NODE 69 MXX -.42946-03 MYY -.565948-03 MXY .14714-03

NODE 91 MXX .75602-03 MYY -.460908-05 MXY .801681-04

CENTROID SXX -.448105+01 SYY +.333615+01 SXY +.431659+01

NODE 86 VXX MXX -.237685-04 VYY +.123598-03 MYY .470926-03 MXY .162793-03

NODE 30 MXX -.755553-05 MYY -.200563-03 MXY .565072-04

NODE 88 MXX -.348622-03 MYY -.2668418-04 MXY .137350-03

CENTROID SXX -.448105+01 SYY +.333615+01 SXY +.431659+01

NODE 86 MXX -.237685-04 VYY +.123598-03 MYY .470926-03 MXY .162793-03

NODE 30 MXX -.348622-03 MYY .200563-03 MXY .565072-04

NODE 88 MXX -.263893-03 MYY -.2668418-04 MXY .137350-03

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|    |          |            |                                 |                          |  |                          |   |
|----|----------|------------|---------------------------------|--------------------------|--|--------------------------|---|
| 71 | CENTROID | XXX<br>VXX | .376881-01<br>MXX<br>MXX<br>MXX | SYY<br>VYY<br>MYY<br>MYY | .-165724-01<br>.303903-03<br>.72205-03<br>.130119-02 | SXY<br>MXY<br>MXY<br>MXY | .-327507-01<br>.288119-04<br>.953503-05<br>.476954-05 |
|    | NODE 86  |            | .675062-03                      | VYY                      | .303903-03   | MXY                      | .288119-04  |
|    | NODE 50  |            | .61685-03                       | MYY                      | .72205-03  | MXY                      | .953503-05  |
|    | NODE 49  |            | .10612-02                       | MYY                      | .130119-02   | MXY                      | .476954-05  |
|    |          |            | .65555-03                       | MYY                      | .303903-03   | MXY                      |   |
| 72 | CENTROID | XXX<br>VXX | .-197820+01<br>.5603598-03      | SYY<br>VYY               | .-719142+00<br>.1003865-05                           | SXY                      | .297841+01  |
|    | NODE 56  |            | MXX<br>MXX<br>MXX               | MYY<br>MYY<br>MYY        | .474473-03<br>.414310-03<br>.560561-03               | MXY<br>MXY<br>MXY        | .273265-04<br>.168954-03<br>.111585-04                |
|    | NODE 32  |            | .53552-03                       | MYY                      |  |                          |   |
|    | NODE 33  |            | .344941-03                      | MYY                      |  |                          |   |
|    |          |            | .6267127-03                     | MYY                      |  |                          |   |
| 73 | CENTROID | XXX<br>VXX | .157476+01<br>.398629-03        | SYY<br>VYY               | .-617972+00<br>.501126-04                            | SXY                      | .169509+01  |
|    | NODE 55  |            | MXX<br>MXX<br>MXX               | MYY<br>MYY<br>MYY        | .-122258-04<br>.645904-05<br>.693873-03              | MXY<br>MXY<br>MXY        | .165365-03<br>.17503-03<br>.226920-03                 |
|    | NODE 32  |            | .325942-03                      | MYY                      |  |                          |   |
|    | NODE 36  |            | .13222-03                       | MYY                      |  |                          |   |
|    |          |            | .823334-03                      | MYY                      |  |                          |   |
| 74 | CENTROID | XXX<br>VXX | .-174075+01<br>.217731-03       | SYY<br>VYY               | .-100424+01<br>.115886-03                            | SXY                      | .176137401  |
|    | NODE 52  |            | MXX<br>MXX<br>MXX               | MYY<br>MYY<br>MYY        | .176757-05<br>.818402-03<br>.238916-03               | MXY<br>MXY<br>MXY        | .216552-03<br>.25025-03<br>.220092-03                 |
|    | NODE 55  |            | .226464-03                      | MYY                      |  |                          |   |
|    | NODE 31  |            | .906741-01                      | MYY                      |  |                          |   |
|    |          |            | .712512-03                      | MYY                      |  |                          |   |
|    |          |            | .295107-03                      | MYY                      |  |                          |   |
| 75 | CENTROID | XXX<br>VXX | .555759-00<br>.166077-03        | SYY<br>VYY               | .169153-01<br>.115886-03                             | SXY                      | .736221-01  |
|    | NODE 56  |            | MXX<br>MXX<br>MXX               | MYY<br>MYY<br>MYY        | .176757-05<br>.818402-03<br>.238916-03               | MXY<br>MXY<br>MXY        | .209269-03<br>.24215-03<br>.169618-03                 |
|    | NODE 59  |            | .926972-03                      | MYY                      |  |                          |   |
|    | NODE 55  |            | .166096-04                      | MYY                      |  |                          |   |
| 76 | CENTROID | XXX<br>VXX | .631762+01<br>.230424-03        | SYY<br>VYY               | .-100424+01<br>.344105-04                            | SXY                      | .983640+00  |
|    | NODE 59  |            | MXX<br>MXX<br>MXX               | MYY<br>MYY<br>MYY        | .-971272-04<br>.225376-03<br>.101655-02              | MXY<br>MXY<br>MXY        | .796168-04<br>.58259-04<br>.103115-03                 |
|    | NODE 26  |            | .554921-03                      | MYY                      |  |                          |   |
|    | NODE 60  |            | .137612-02                      | MYY                      |  |                          |   |
|    |          |            | .744076-04                      | MYY                      |  |                          |   |
| 77 | CENTROID | XXX<br>VXX | .282264+01<br>.530332-04        | SYY<br>VYY               | .-317954+01<br>.393265-04                            | SXY                      | .192860+01  |
|    | NODE 60  |            | MXX<br>MXX<br>MXX               | MYY<br>MYY<br>MYY        | .-993377-03<br>.130715-03<br>.404414-03              | MXY<br>MXY<br>MXY        | .197045-03<br>.25331-03<br>.776440-03                 |
|    | NODE 71  |            | .140539-02                      | MYY                      |  |                          |   |
|    | NODE 59  |            | .12762-03                       | MYY                      |  |                          |   |
|    |          |            | .454180-03                      | MYY                      |  |                          |   |
| 78 | CENTROID | XXX<br>VXX | .-165119+01<br>.02320-02        | SYY<br>VYY               | .-871078+01<br>.551010-03                            | SXY                      | .858874+00  |
|    | NODE 71  |            | MXX<br>MXX<br>MXX               | MYY<br>MYY<br>MYY        | .-168724-02<br>.863703-03<br>.778579-03              | MXY<br>MXY<br>MXY        | .322842-03<br>.174538-03<br>.491199-03                |
|    | NODE 60  |            | .155493-02                      | MYY                      |  |                          |   |
|    | NODE 72  |            | .675010-03                      | MYY                      |  |                          |   |

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|----|----------|-----|-------------|-----|-------------|-----|-------------|
| 79 | CENTROID | SXX | *.410316+00 | SYY | *.838699+01 | SXY | *.116741+01 |
|    | NUDE 72  | VXX | .993768-03  | VYY | -.260189-02 | MXY | *.55598-03  |
|    | NUDE 73  | MXX | -.193159-02 | MTY | *.201008-02 | MXY | *.581564-03 |
|    | NUDE 74  | MXX | -.274987-02 | MTY | *.298058-02 | MXY | *.425583-03 |
| 80 | CENTROID | SXX | *.563577+01 | SYY | .399715+01  | SXY | *.142505+02 |
|    | NUDE 74  | VXX | .244414-03  | VYY | .649991-04  | MXY | *.210184-03 |
|    | NUDE 75  | MXX | -.860153-03 | MTY | -.109170-02 | MXY | *.527461-03 |
|    | NUDE 76  | MXX | -.550044-03 | MTY | -.464068-03 | MXY | *.373217-03 |
| 81 | CENTROID | SXX | *.136323+02 | SYY | *.157333+01 | SXY | *.627272+01 |
|    | NUDE 74  | VXX | -.194634-02 | VYY | .409993-02  | MXY | *.18341-03  |
|    | NUDE 75  | MXX | -.373121-03 | MTY | *.176112-03 | MXY | *.608927-04 |
|    | NUDE 76  | MXX | .788222-02  | MTY | *.829782-02 | MXY | *.600474-03 |
| 82 | CENTROID | SXX | *.578256+01 | SYY | *.668025+01 | SXY | *.769346+01 |
|    | NUDE 75  | VXX | .758196-03  | VYY | .156828-02  | MXY | *.239619-04 |
|    | NUDE 74  | MXX | *.403111-02 | MTY | *.420412-02 | MXY | *.249537-03 |
|    | NUDE 76  | MXX | *.172291-02 | MTY | *.177583-02 | MXY | *.13053-03  |
| 83 | CENTROID | SXX | *.336643+01 | SYY | *.237369+01 | SXY | *.701265+01 |
|    | NUDE 76  | VXX | .306172-03  | VYY | .342235-03  | MXY | *.41012-03  |
|    | NUDE 75  | MXX | *.20999-02  | MTY | *.247159-02 | MXY | *.290831-04 |
|    | NUDE 74  | MXX | *.434522-02 | MTY | *.54124-02  | MXY | *.330849-03 |
| 84 | CENTROID | SXX | *.370376+01 | SYY | *.514148+01 | SXY | *.532331+01 |
|    | NUDE 75  | VXX | .12647-02   | VYY | *.381426-02 | MXY | *.323077-03 |
|    | NUDE 76  | MXX | .755263-02  | MTY | *.010122-02 | MXY | *.535227-04 |
|    | NUDE 77  | MXX | *.568375-03 | MTY | *.153759-02 | MXY | *.120374-03 |
| 85 | CENTROID | SXX | *.270530+01 | SYY | *.625067+00 | SXY | *.215193+01 |
|    | NUDE 76  | VXX | .715659-04  | VYY | -.412668-03 | MXY | *.286262-04 |
|    | NUDE 46  | MXX | -.271832-03 | MTY | *.377689-03 | MXY | *.494435-04 |
|    | NUDE 77  | MXX | *.87864-03  | MTY | *.664171-03 | MXY | *.173238-04 |
| 86 | CENTROID | SXX | *.115526+02 | SYY | *.158835+02 | SXY | *.221913+02 |
|    | NUDE 40  | VXX | .422295-03  | VYY | -.520520-02 | MXY | *.938257-03 |
|    | NUDE 78  | MXX | -.172705-02 | MTY | *.257616-02 | MXY | *.19868-03  |
|    | NUDE 41  | MXX | *.633552-02 | MTY | *.454053-02 | MXY | *.912338-03 |

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CENTROID

NODE 77

SXX  
VXX

NODE 40

SXX  
VXX

NODE 59

SYY  
VYY

NODE 79

SYY  
VYY

NODE 40

SYY  
VYY

NODE 59

-0.210061+02 SYY

NODE 79

-0.109115-02 VYY

NODE 40

-0.961557-03 MYY

NODE 59

-0.693001-02 MYY

NODE 40

-0.907519-03 MYY

NODE 59

-0.469902+00 SKY

NODE 79

-0.615158-03 MXY

NODE 40

-0.17487-02 MXY

NODE 59

-0.33721-02 MXY

NODE 40

-0.423517-02 MXY

NODE 59

-0.137569+01 SKY

NODE 79

SXX  
VXX

NODE 40

SYY  
VYY

NODE 79

SYY  
VYY

NODE 40

SYY  
VYY

NODE 59

-0.462556+01 SKY

NODE 79

-0.372036-02 MYY

NODE 40

-0.986111-03 MXY

NODE 59

-0.50676-02 MXY

NODE 40

-0.643103-02 MXY

NODE 59

-0.5866681+01 SKY

NODE 79

-0.351069+01 SKY

NODE 40

SXX  
VXX

NODE 79

SYY  
VYY

NODE 40

SYY  
VYY

NODE 59

-0.362144+01 SKY

NODE 79

-0.277231-02 MYY

NODE 40

-0.137156-02 MXY

NODE 59

-0.350630-02 MXY

NODE 40

-0.463555-02 MXY

NODE 59

-0.521152-03 MXY

NODE 40

-0.359033+01 SKY

NODE 79

SXX  
VXX

NODE 40

SYY  
VYY

NODE 59

SYY  
VYY

NODE 79

-0.191138+02 SKY

NODE 40

-0.450563-02 MYY

NODE 59

-0.193390-02 MXY

NODE 40

-0.362119-02 MXY

NODE 59

-0.757233-02 MXY

NODE 40

-0.3599033+01 SKY

NODE 79

SXX  
VXX

NODE 40

SYY  
VYY

NODE 59

-0.104107+02 SKY

NODE 79

-0.168029-02 MYY

NODE 40

-0.720244-05 MXY

NODE 59

-0.261633-03 MXY

NODE 40

-0.450830-02 MXY

NODE 59

-0.574965+01 SKY

NODE 79

SXX  
VXX

NODE 40

SYY  
VYY

NODE 59

-0.143733-02 SKY

NODE 79

-0.262315-02 MYY

NODE 40

-0.233330-02 MXY

NODE 59

-0.6467386-03 MXY

NODE 40

-0.891293-03 MXY

NODE 59

-0.626780+01 SKY

NODE 79

SXX  
VXX

NODE 40

SYY  
VYY

NODE 59

-0.5393163+01 SKY

NODE 79

-0.135345-02 MYY

NODE 40

-0.296756-02 MXY

NODE 59

-0.262285-02 MXY

NODE 40

-0.433374-03 MXY

NODE 59

-0.205771-03 MXY

NODE 40

-0.467386-03 MXY

NODE 59

-0.865239+01 SKY

NODE 79

SXX  
VXX

NODE 40

SYY  
VYY

NODE 59

-0.117632+02 SKY

NODE 79

-0.659759-03 MYY

NODE 40

-0.198639-02 MXY

NODE 59

-0.433374-03 MXY

NODE 40

-0.205771-03 MXY

NODE 59

-0.467386-03 MXY

NODE 40

-0.369365+01 SKY

NODE 79

SXX  
VXX

NODE 40

SYY  
VYY

NODE 59

-0.505128-03 MYY

NODE 40

-0.243980-03 MXY

NODE 59

-0.507269-03 MXY

NODE 40

-0.174246-03 MXY

NODE 59

-0.135476-03 MXY

NODE 40

-0.65676+01 SKY

NODE 79

## UNIVAC 1100 SERIES ICES

DATE 073000

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|          |     |             |     |             |     |            |
|----------|-----|-------------|-----|-------------|-----|------------|
| CENTROID | SXX | .637956+01  | SYY | .224N804+01 | SXY | .125821+02 |
| NODE 84  | VXX | .9331954-03 | VYY | .2332131-02 |     |            |
| NODE 85  | MXX | .410312-03  | MYY | .18637-03   | MXY | .962247-00 |
| NODE 85  | MXX | .210474-03  | MYY | .192517-03  | MXY | .260763-03 |
| NODE 85  | MXX | .125235-03  | MYY | .430129-03  | MXY | .822695-00 |

|          |     |            |     |            |     |            |
|----------|-----|------------|-----|------------|-----|------------|
| CENTROID | SXX | .574252+01 | SYY | .415727+01 | SXY | .326206+01 |
| NODE 85  | VXX | .244018-03 | VYY | .159369-03 |     |            |
| NODE 86  | MXX | .457083-03 | MYY | .16682-03  | MXY | .479020-00 |
| NODE 86  | MXX | .296212-03 | MYY | .996173-03 | MXY | .479020-00 |
| NODE 86  | MXX | .169374-04 | MYY | .390321-03 | MXY | .156069-03 |

|          |     |            |     |            |     |            |
|----------|-----|------------|-----|------------|-----|------------|
| CENTROID | SXX | .587976+01 | SYY | .452641+01 | SXY | .306261+01 |
| NODE 85  | VXX | .139546-03 | VYY | .281940-03 |     |            |
| NODE 86  | MXX | .630561-03 | MYY | .664945-04 | MXY | .366870-00 |
| NODE 86  | MXX | .424298-03 | MYY | .207271-03 | MXY | .771221-00 |
| NODE 86  | MXX | .121814-03 | MYY | .645249-03 | MXY | .255931-00 |

|          |     |            |     |            |     |            |
|----------|-----|------------|-----|------------|-----|------------|
| CENTROID | SXX | .494285+01 | SYY | .168722+01 | SXY | .139961+01 |
| NODE 85  | VXX | .876735-04 | VYY | .159448-03 |     |            |
| NODE 86  | MXX | .119116-03 | MYY | .344216-03 | MXY | .771223-00 |
| NODE 86  | MXX | .508766-03 | MYY | .656086-03 | MXY | .713026-00 |
| NODE 86  | MXX | .304775-03 | MYY | .358212-03 | MXY | .496184-00 |

|          |     |            |     |            |     |            |
|----------|-----|------------|-----|------------|-----|------------|
| CENTROID | SXX | .689869+01 | SYY | .208200+01 | SXY | .515009+00 |
| NODE 85  | VXX | .189331-03 | VYY | .222504-03 |     |            |
| NODE 86  | MXX | .317534-03 | MYY | .734334-03 | MXY | .139997-00 |
| NODE 86  | MXX | .223561-03 | MYY | .598845-03 | MXY | .189011-00 |
| NODE 86  | MXX | .410645-03 | MYY | .111746-03 | MXY | .747093-00 |

|          |     |            |     |            |     |            |
|----------|-----|------------|-----|------------|-----|------------|
| CENTROID | SXX | .677208+00 | SYY | .159820+01 | SXY | .103909+01 |
| NODE 86  | VXX | .704422-04 | VYY | .197679-04 |     |            |
| NODE 87  | MXX | .275985-03 | MYY | .717983-04 | MXY | .288006-03 |
| NODE 87  | MXX | .111756-03 | MYY | .102334-03 | MXY | .306818-03 |
| NODE 87  | MXX | .612030-04 | MYY | .909327-04 | MXY | .306877-03 |

|          |     |            |     |            |     |            |
|----------|-----|------------|-----|------------|-----|------------|
| CENTROID | SXX | .187902+00 | SYY | .966667+00 | SXY | .162707+01 |
| NODE 85  | VXX | .539116-04 | VYY | .998828-04 |     |            |
| NODE 85  | MXX | .126163-03 | MYY | .415110-04 | MXY | .247647-00 |
| NODE 85  | MXX | .213009-03 | MYY | .346469-03 | MXY | .253395-00 |
| NODE 85  | MXX | .107381-03 | MYY | .910549-04 | MXY | .328061-03 |

|          |     |            |     |            |     |            |
|----------|-----|------------|-----|------------|-----|------------|
| CENTROID | SXX | .211986+01 | SYY | .538262+01 | SXY | .176652+01 |
| NODE 85  | VXX | .137500-03 | VYY | .416665-04 |     |            |

| UNIVAC 1100 SERIES ICES |     |             |     |              |     |              |  |  |  |
|-------------------------|-----|-------------|-----|--------------|-----|--------------|--|--|--|
|                         |     |             |     |              |     |              |  |  |  |
| NUDE 17                 | MAX | .0482327-04 | MYY | .196363-03   | MXY | .-306928-03  |  |  |  |
| NUDE 35                 | MAX | .05403-05   | MYY | .46282-03    | MXY | .-249924-03  |  |  |  |
| NUDE 18                 | MAX | .-163704-03 | MYY | .40106-04    | MXY | .-2666237-03 |  |  |  |
| CENTROID                | SXX | .402433+00  | SYY | .-821380-01  | SXY | .-63376+00   |  |  |  |
| NUDE 35                 | VXX | .160392-03  | VYY | .734417-05   | MXY | .-257271-03  |  |  |  |
| NUDE 19                 | MAX | .516134-03  | MYY | .360743-03   | MXY | .-24954-03   |  |  |  |
| NUDE 18                 | MAX | .123278-03  | MYY | .162229-03   | MXY | .-242511-03  |  |  |  |
| CENTROID                | SXX | .-164685+01 | SYY | .-104500-01  | SXY | .290193+01   |  |  |  |
| NUDE 35                 | VXX | .174684-03  | VYY | .600576-04   | MXY | .-198337-03  |  |  |  |
| NUDE 39                 | MAX | .299960-03  | MYY | .526138-03   | MXY | .-193642-03  |  |  |  |
| NUDE 19                 | MAX | .651061-03  | MYY | .692591-03   | MXY | .-270369-03  |  |  |  |
| CENTROID                | SXX | .633599+01  | SYY | .-1694356-02 | SXY | .366425+01   |  |  |  |
| NUDE 19                 | VXX | .253957-03  | VYY | .-177481-03  | MXY | .-20455-03   |  |  |  |
| NUDE 39                 | MAX | .331003-03  | MYY | .359991-03   | MXY | .-67060-04   |  |  |  |
| NUDE 20                 | MAX | .706196-03  | MYY | .701768-03   | MXY | .-134719-03  |  |  |  |
| CENTROID                | SXX | .454534+01  | SYY | .-106097-02  | SXY | .-87365+01   |  |  |  |
| NUDE 59                 | VXX | .302775-03  | VYY | .204928-03   | MXY |              |  |  |  |
| NUDE 21                 | MAX | .720431-03  | MYY | .705878-03   | MXY | .-67933-04   |  |  |  |
| NUDE 20                 | MAX | .616554-03  | MYY | .545061-03   | MXY | .-258934-04  |  |  |  |
| CENTROID                | SAX | .-449602-01 | SYY | .46219+01    | SXY | .990613+00   |  |  |  |
| NUDE 59                 | VAX | .-43960-05  | VYY | .-606320-04  | MXY | .421062-04   |  |  |  |
| NUDE 71                 | MAX | .63120-03   | MYY | .368759-03   | MXY | .-676229-04  |  |  |  |
| NUDE 21                 | MAX | .553972-03  | MYY | .351665-03   | MXY | .-258864-04  |  |  |  |
| CENTROID                | SAX | .-530332+01 | SYY | .-181669-01  | SXY | .-141821+01  |  |  |  |
| NUDE 21                 | VAX | .-232674-03 | VYY | .-168209-03  | MXY | .-687547-04  |  |  |  |
| NUDE 71                 | MAX | .503442-03  | MYY | .380091-03   | MXY | .-826624-04  |  |  |  |
| NUDE 21                 | MAX | .714974-03  | MYY | .460085-03   | MXY | .-673222-04  |  |  |  |
| CENTROID                | SXX | .-790813+01 | SYY | .-200466+01  | SXY | .171695+01   |  |  |  |
| NUDE 22                 | VXX | .-128601-02 | VYY | .-131397-02  | MXY | .-266953-03  |  |  |  |
| NUDE 71                 | MAX | .-16823-02  | MYY | .124627-03   | MXY | .-223571-03  |  |  |  |
| NUDE 73                 | MAX | .946755-03  | MYY | .167925-02   | MXY | .-661471-03  |  |  |  |
| CENTROID                | SXX | .124501+01  | SYY | .-2246399-01 | SXY | .556701+01   |  |  |  |
| NUDE 73                 | VAX | .-233664-03 | VYY | .-409762-03  | MXY | .-156903-03  |  |  |  |

| UNIVAT 1100 SERIES ICES |     |             |              |             |             |             |              |     |     |
|-------------------------|-----|-------------|--------------|-------------|-------------|-------------|--------------|-----|-----|
| NODE                    | 23  | MXX         | -103427-02   | MYY         | -276930-04  | MXY         | -0161680-03  | MXX | MYY |
| NODE                    | 22  | MXX         | .668945-04   | MYY         | .121626-02  | MXY         | -.0240613-03 | MXX | MYY |
| CENTROID                | SXX | *621477+01  | SYY          | *392102+00  | SXY         | *661634+01  |              |     |     |
| NODE                    | 23  | VXX         | .125727-02   | VYY         | .432386-02  | MYY         | *345773-03   | MXX | MYY |
| NODE                    | 73  | MXX         | -.21046-02   | MYY         | -.236707-02 | MYY         | *124504-04   | MXX | MYY |
| NODE                    | 75  | MXX         | -.542442-02  | MYY         | -.561082-02 | MYY         | *562767-03   | MXX | MYY |
| CENTROID                | SXX | *287553+01  | SYY          | *8989522+01 | SXY         | *799766+00  |              |     |     |
| NODE                    | 75  | VXX         | .754407-03   | VYY         | .498670-03  | MYY         | *351969-03   | MXX | MYY |
| NODE                    | 24  | MXX         | .434483-02   | MYY         | .491112-02  | MYY         | *668737-03   | MXX | MYY |
| NODE                    | 23  | MXX         | .172431-02   | MYY         | .188668-02  | MYY         | *02107-03    | MXX | MYY |
| CENTROID                | SXX | *417634+01  | SYY          | *419599+01  | SXY         | *519619+01  |              |     |     |
| NODE                    | 24  | VXX         | .304502-03   | VYY         | -.334467-02 | MYY         | *70843-03    | MXX | MYY |
| NODE                    | 75  | MXX         | .169129-02   | MYY         | .243336-02  | MYY         | *140642-03   | MXX | MYY |
| NODE                    | 77  | MXX         | .760897-02   | MYY         | .81023-02   | MYY         | *587504-03   | MXX | MYY |
| CENTROID                | SXX | *120954+02  | SYY          | *205635+01  | SXY         | *109407+02  |              |     |     |
| NODE                    | 59  | VXX         | .155308-03   | VYY         | -.722895-03 | MYY         | *71942-04    | MXX | MYY |
| NODE                    | 24  | MXX         | -.257593-02  | MYY         | -.454942-02 | MYY         | *405476-02   | MXX | MYY |
| NODE                    | 77  | MXX         | -.337661-03  | MYY         | -.203953-02 | MYY         | *501157-03   | MXX | MYY |
| CENTROID                | SXX | *312634+01  | SYY          | *736205+01  | SXY         | *269138+01  |              |     |     |
| NODE                    | 59  | VXX         | -.126777-03  | VYY         | .135324-02  | MYY         | *108892-02   | MXX | MYY |
| NODE                    | 24  | MXX         | -.144119-02  | MYY         | -.31461-02  | MYY         | *143068-03   | MXX | MYY |
| NODE                    | 59  | MXX         | -.119679-02  | MYY         | -.22211-02  | MYY         | *443069-03   | MXX | MYY |
| NODE                    | 25  | MXX         | .755559-03   | MYY         | .153926-03  | MYY         | *412924-03   | MXX | MYY |
| CENTROID                | SXX | *5053956+01 | SYY          | *715968+01  | SXY         | *5589999+01 |              |     |     |
| NODE                    | 59  | VXX         | -.0331810-04 | VYY         | -.462226-03 | MYY         | *174571-02   | MXX | MYY |
| NODE                    | 26  | MXX         | -.714158-05  | MYY         | -.312211-02 | MYY         | *03012-03    | MXX | MYY |
| NODE                    | 25  | MXX         | -.138151-04  | MYY         | -.30012-03  | MYY         | *501668-02   | MXX | MYY |
| CENTROID                | SXX | *19011+01   | SYY          | *116766+01  | SXY         | *6407225+02 |              |     |     |
| NODE                    | 26  | VXX         | .170014-03   | VYY         | .593354-02  | MYY         | *325836-03   | MXX | MYY |
| NODE                    | 39  | MXX         | -.129466-02  | MYY         | -.25265-02  | MYY         | *851757-04   | MXX | MYY |
| NODE                    | 79  | MXX         | -.750339-02  | MYY         | -.053727-02 | MYY         | *214032-03   | MXX | MYY |
| CENTROID                | SXX | *203088+00  | SYY          | *115465+02  | SXY         | *442620+01  |              |     |     |
| NODE                    | 61  | VXX         | *251284-03   | VYY         | -.122920-02 | MYY         | *673468-03   | MXX | MYY |
| NODE                    | 26  | MXX         | *77651-03    | MYY         | *103200-04  | MYY         | *203877-03   | MXX | MYY |

## UNIVAC 1100 SERIES ICES

|     | NODE     | 79  | MAX         | .305347+02 | MTY          | .305347+02   | MTY         | .275128+03  | DATE 073080 | PAGE |
|-----|----------|-----|-------------|------------|--------------|--------------|-------------|-------------|-------------|------|
| 120 | CENTROID | SXX | .975360+00  | STY        | *.131709+02  | SKY          |             |             | .840017+01  |      |
|     | NUDE     | 26  | VXX         | .349511+03 | VYY          | *.721261+03  |             |             |             |      |
|     | NUDE     | 51  | MAX         | .176409+02 | MTY          | .18209+02    | MTY         | *.686697+04 |             |      |
|     | NUDE     | 51  | MAX         | .265084+01 | MTY          | .270116+02   | MTY         | *.221252+03 |             |      |
|     | NUDE     | 27  | MAX         | .753149+02 | MTY          | .288771+03   | MTY         | *.640636+05 |             |      |
| 121 | CENTROID | SXX | .728750+01  | STY        | *.103620+02  | SKY          |             |             | .460577+01  |      |
|     | NUDE     | 83  | VXX         | .635866+04 | VYY          | *.126275+02  |             |             |             |      |
|     | NUDE     | 27  | MAX         | .106759+02 | MTY          | *.883257+03  | MTY         | *.703332+04 |             |      |
|     | NUDE     | 51  | MAX         | .739493+05 | MTY          | .654813+03   | MTY         | *.221496+05 |             |      |
|     |          |     | .246634+02  | MTY        | .240207+02   | MTY          | *.12860+03  |             |             |      |
| 122 | CENTROID | SXX | .157012+01  | STY        | *.142678+02  | SKY          |             |             | .873450+01  |      |
|     | NUDE     | 83  | VXX         | .159263+03 | VYY          | .269358+03   |             |             |             |      |
|     | KDC      | 26  | MAX         | .437803+03 | MTY          | .686465+03   | MTY         | *.412916+03 |             |      |
|     | NUDE     | 51  | MAX         | .152254+03 | MTY          | .635557+03   | MTY         | *.40201+03  |             |      |
|     | NUDE     | 27  | MAX         | .425557+03 | MTY          | .539201+04   | MTY         | *.541697+03 |             |      |
| 123 | CENTROID | SXX | .74749+01   | STY        | *.231102+01  | SKY          |             |             | .533322+01  |      |
|     | NUDE     | 28  | VXX         | .247328+34 | VYY          | .358305+04   |             |             |             |      |
|     | NUDE     | 53  | MAX         | .253104+05 | MTY          | .812255+04   | MTY         | *.412246+03 |             |      |
|     | NUDE     | 51  | MAX         | .281735+05 | MTY          | .268448+03   | MTY         | *.410022+03 |             |      |
|     |          |     | .115660+03  | MTY        | .272522+03   | MTY          | *.419258+03 |             |             |      |
| 124 | CENTROID | SXX | .10089+01   | STY        | *.90006+01   | SKY          |             |             | .349303+00  |      |
|     | NUDE     | 85  | VXX         | .725560+04 | VYY          | .486671+04   |             |             |             |      |
|     | NUDE     | 29  | MAX         | .923346+04 | MTY          | .424887+03   | MTY         | *.207476+03 |             |      |
|     | NUDE     | 28  | MAX         | .66+52+04  | MTY          | .598021+03   | MTY         | *.210023+03 |             |      |
|     |          |     | .153117+03  | MTY        | .399358+03   | MTY          | *.208497+03 |             |             |      |
| 125 | CENTROID | SXX | .396623+01  | STY        | *.916648+00  | SKY          |             |             | .653373+01  |      |
|     | NUDE     | 87  | VXX         | .547435+04 | VYY          | .369833+03   |             |             |             |      |
|     | NUDE     | 29  | MAX         | .792494+05 | MTY          | .631266+03   | MTY         | *.251653+03 |             |      |
|     | NUDE     | 51  | MAX         | .313753+05 | MTY          | .122771+03   | MTY         | *.202779+03 |             |      |
|     | NUDE     | 47  | MAX         | .112689+05 | MTY          | .388165+03   | MTY         | *.211879+03 |             |      |
| 126 | CENTROID | SXX | .2258547+01 | STY        | *.2221545+01 | SKY          |             |             | .346411+01  |      |
|     | NUDE     | 29  | VXX         | .146019+03 | VYY          | *.2137367+03 |             |             |             |      |
|     | NUDE     | 47  | MAX         | .16153+04  | MTY          | .347245+03   | MTY         | *.90507+03  |             |      |
|     | NUDE     | 47  | MAX         | .44475+03  | MTY          | .245817+04   | MTY         | *.121936+03 |             |      |
|     |          |     | .530792+04  | MTY        | .208743+04   | MTY          | *.901642+04 |             |             |      |
| 127 | CENTROID | SXX | .641901+01  | STY        | *.842101+01  | SKY          |             |             | .750074+01  |      |
|     | NUDE     | 29  | VXX         | .23629+04  | VYY          | *.494434+05  |             |             |             |      |
|     | NUDE     | 47  | MAX         | .79047+04  | MTY          | .250364+04   | MTY         | *.152401+03 |             |      |
|     | NUDE     | 30  | MAX         | .11249+05  | MTY          | .186677+03   | MTY         | *.739317+04 |             |      |
|     |          |     | .249591+04  | MTY        | .616257+04   | MTY          | *.113196+03 |             |             |      |

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| CENTROID | SXX               | SYY               | SXY               | .153401+01 |
|----------|-------------------|-------------------|-------------------|------------|
| NODE 97  | .252921-01<br>MAX | .7200640000<br>VY | .144002-03<br>MTY | .169363-03 |
| NODE 97  | .524222-04<br>MAX | .908584-04<br>MAX | .256585-03<br>MTY | .507634-04 |
| NODE 98  |                   | .999156-04<br>MAX | .371688-03<br>MTY | .131790-03 |
|          |                   | .378496-03<br>MAX | .717022-03<br>MTY |            |

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649-2924-001  
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## LOADING - DMAG

## RESULTANT JOINT LOADS - SUPPORTS

| JOINT   | X FORCE | Y FORCE | Z FORCE | X MOMENT | Y MOMENT | Z MOMENT |
|---------|---------|---------|---------|----------|----------|----------|
| 101 GLO | .012    | .000    | .000    | .000     | .000     | .000     |
| 102 GLO | .000    | .000    | .000    | .000     | .000     | .000     |
| 103 GLO | .003    | .000    | .000    | .012     | .000     | .000     |
| 104 GLO | .000    | .000    | .000    | .011     | .000     | .000     |
| 105 GLO | .002    | .000    | .000    | .000     | .000     | .000     |
| 106 GLO | .001    | .000    | .000    | .039     | .016     | .000     |
| 107 GLO | .100    | .000    | .000    | .003     | .000     | .000     |
| 108 GLO | .000    | .000    | .000    | .000     | .000     | .000     |
| 109 GLO | .001    | .000    | .000    | .009     | .000     | .000     |
| 110 GLO | .000    | .000    | .000    | .020     | .000     | .000     |
| 111 GLO | .000    | .000    | .023    | .000     | .000     | .000     |
| 112 GLO | .001    | .000    | .000    | .002     | .000     | .000     |
| 113 GLO | .002    | .000    | .000    | .002     | .001     | .000     |
| 114 GLO | .002    | .000    | .000    | .002     | .000     | .000     |
| 115 GLO | .002    | .000    | .000    | .002     | .001     | .000     |
| 116 GLO | .000    | .000    | .001    | .000     | .000     | .000     |
| 117 GLO | .000    | .000    | .001    | .000     | .000     | .000     |
| 118 GLO | .000    | .000    | .000    | .000     | .000     | .000     |
| 119 GLC | .000    | .000    | .000    | .003     | .000     | .000     |
| 120 GLO | .000    | .000    | .000    | .000     | .000     | .000     |
| 121 GLO | .000    | .000    | .000    | .001     | .000     | .000     |
| 122 GLO | .000    | .000    | .000    | .021     | .000     | .000     |
| 123 GLO | .000    | .000    | .000    | .020     | .000     | .000     |
| 124 GLO | .000    | .000    | .000    | .050     | .012     | .000     |
| 125 GLO | .000    | .000    | .000    | .005     | .000     | .000     |
| 126 GLO | .000    | .000    | .000    | .019     | .000     | .000     |
| 127 GLO | .000    | .000    | .000    | .001     | .000     | .000     |
| 128 GLO | .000    | .000    | .000    | .007     | .000     | .000     |
| 129 GLO | .000    | .000    | .000    | .001     | .000     | .000     |
| 130 GLO | .000    | .000    | .000    | .012     | .000     | .000     |
| 131 GLO | .000    | .000    | .000    | .005     | .000     | .000     |
| 132 GLO | .000    | .000    | .000    | .015     | .000     | .000     |
| 133 GLO | .000    | .000    | .000    | .002     | .000     | .000     |
| 134 GLO | .000    | .000    | .000    | .017     | .017     | .000     |
| 135 GLO | .000    | .000    | .000    | .001     | .000     | .000     |
| 136 GLO | .000    | .000    | .000    | .003     | .000     | .000     |
| 137 GLO | .000    | .000    | .000    | .002     | .000     | .000     |
| 138 GLO | .000    | .000    | .000    | .016     | .000     | .000     |
| 139 GLO | .000    | .000    | .000    | .035     | .004     | .000     |
| 140 GLO | .000    | .000    | .000    | .017     | .026     | .000     |
| 141 GLO | .000    | .000    | .000    | .012     | .035     | .003     |
| 142 GLO | .000    | .000    | .000    | .007     | .089     | .002     |
| 143 GLO | .000    | .000    | .000    | .008     | .020     | .003     |
| 144 GLO | .000    | .000    | .000    | .008     | .018     | .003     |
| 145 GLO | .000    | .000    | .000    | .007     | .003     | .000     |

## UNIVAC 1100 SERIES ICES

|               |     | DATE 073060  | PAGE        | 39          |
|---------------|-----|--------------|-------------|-------------|
| 146           | GLO | .009         |             | -.000       |
| 147           | GLO | .000         | .008        | -.000       |
| 148           | GLO | .000         | .003        | -.000       |
| 149           | GLO | .000         | .005        | -.000       |
| 150           | GLO | .000         | .002        | -.000       |
| 151           | GLO | .000         | .030        | -.000       |
| 152           | GLO | .000         | .001        | -.000       |
| 153           | GLO | .000         | .006        | -.000       |
| 154           | GLO | .000         | .000        | -.000       |
| <b>TOTALS</b> |     | <b>-.091</b> | <b>.024</b> | <b>.001</b> |

## RESULTANT JOINT DISPLACEMENTS - SUPPORTS

| JOINT | DISPLACEMENTS |         |         | ROTATIONS |       |       |
|-------|---------------|---------|---------|-----------|-------|-------|
|       | X DISPL       | Y DISPL | Z DISPL | X ROT     | Y ROT | Z ROT |
| 101   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 102   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 103   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 104   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 105   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 106   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 107   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 108   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 109   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 110   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 111   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 112   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 113   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 114   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 115   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 116   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 117   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 118   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 119   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 120   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 121   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 122   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 123   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 124   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 125   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 126   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 127   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 128   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 129   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 130   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 131   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 132   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 133   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 134   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 135   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 136   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 137   | GLO           | .000    | .000    | .000      | .000  | .000  |
| 138   | GLO           | .000    | .000    | .000      | .000  | .000  |

SUMMARY

A STRESS ANALYSIS WAS PERFORMED ON THE ANTENNA ADAPTER MOUNT (649-2848-001) UNDER WHAT WAS CONSIDERED A WORST CASE AERODYNAMIC LOADING CONDITION OF THE ANTENNA. THE ANALYSIS OF THE CASTING SHOWS THAT IT IS OF SUFFICIENT STRENGTH TO CARRY ALL INDUCED LOADS WITH THE FOLLOWING MARGINS-OF-SAFETY (CASTING FACTOR OF 2.0 INCLUDED):

MS (CASTING TENSILE YIELD) = +2.24  
MS (CASTING SHEAR ULT) = +11.2  
MS (ATTACHMENT BOLTS TENSION) = +30.4

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET<br><b>95</b>             |

AD-A095 634      ROCKWELL INTERNATIONAL DALLAS TEX COLLINS RADIO GROUP      F/G 1/3  
STRESS ANALYSIS OF AIRCRAFT MODIFICATIONS (C-141B AIRCRAFT). JO--ETC(U)  
OCT 80      D B RAGAN      F09603-80-C-0602

UNCLASSIFIED

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232  
29.6.8

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DATE FILMED  
13-8-81  
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## APPENDICES

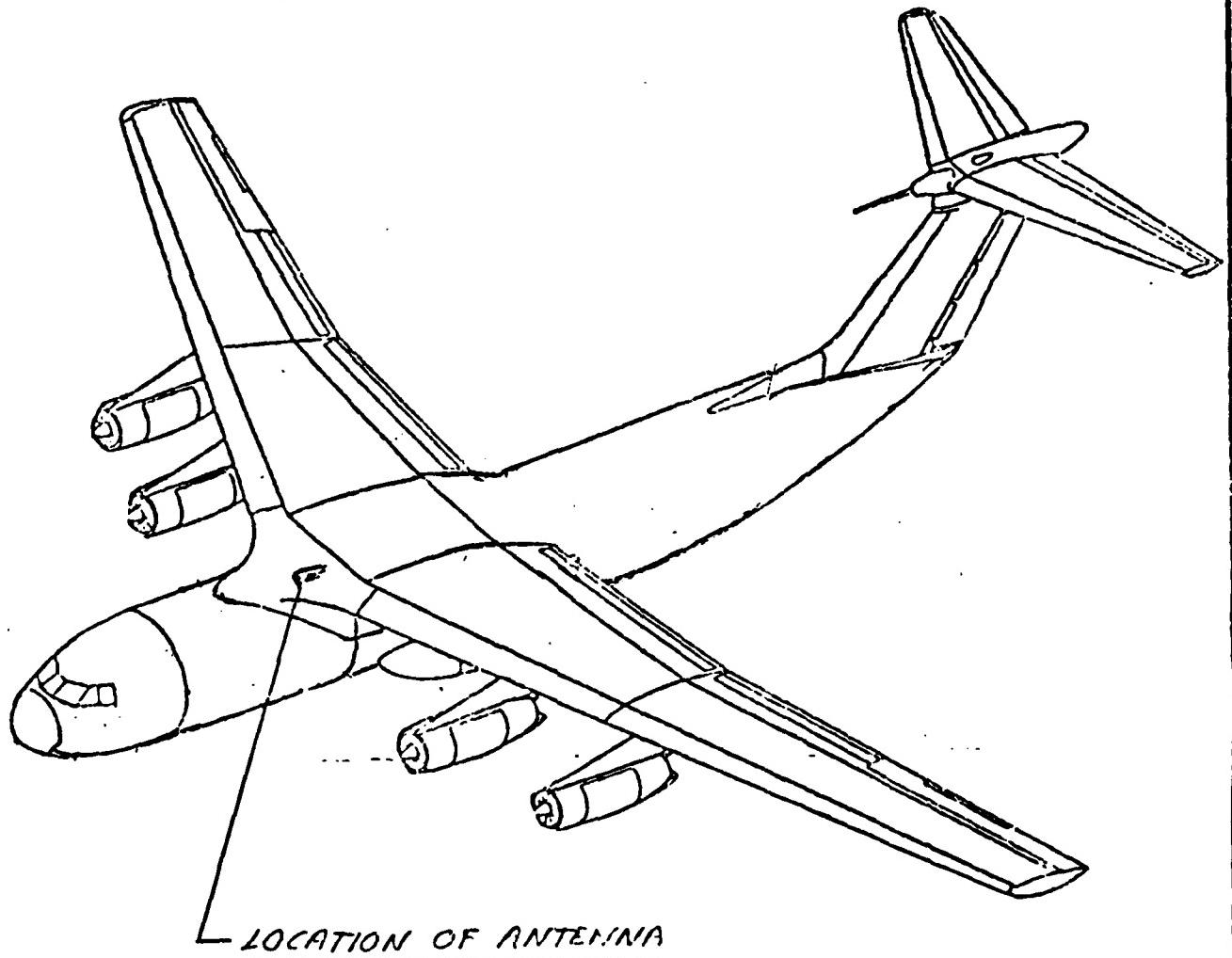
- A AERODYNAMIC LOADING CALCULATIONS
- B LISTING OF COMPUTER RESULTS

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET <b>96</b>                |

**'C141-B'    'DM C34-3/B UHF ANTENNA MOD'**

\*\*\*\*\*  
\*  
\* ICES STRUDL-II  
\* THE STRUCTURAL DESIGN LANGUAGE  
\*  
\* CIVIL ENGINEERING SYSTEMS LABORATORY  
\* MASSACHUSETTS INSTITUTE OF TECHNOLOGY  
\* CAMBRIDGE, MASSACHUSETTS  
\*  
\* 17.14.36                  22 AUG 80  
\*  
\* UNIVAC 1100 SERIES EXEC 8  
\* VERSION 2.7  
\*  
\*\*\*\*\*

PREPARED BY      MAARTEN VET



|                  |                             |                                |
|------------------|-----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>134.99</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                         | SHEET    97                    |

## 1.0 INTRODUCTION

A STRESS ANALYSIS WILL BE PERFORMED ON THE ADAPTER CASTING WHICH IS THE TRANSITION BETWEEN THE DM C34-3/B UHF ANTENNA AND THE FUSELAGE OF THE C141-B AIRCRAFT. THE ADAPTER WAS ADDED TO COMPENSATE FOR THE 7-DEGREE FORWARD SLOPE OF THE FUSELAGE; THUS THE ANTENNA WILL FLY WITH A ZERO ANGLE OF ATTACK. THE LOADINGS TO BE CONSIDERED ARE THE AERODYNAMIC FORCES INDUCED DUE TO EITHER THE MAXIMUM PERMISSIBLE VELOCITY OF 380 KNOTS AT SEA LEVEL OR MACH 0.85 ABOVE 23,000 FEET ALTITUDE; WHICHEVER PRESENTS THE WORST CASE CONDITION. HOWEVER, TO ENSURE THAT A CONSERVATIVE ANALYSIS IS PRESENTED, THE AERODYNAMIC FORCES WILL BE CALCULATED FOR AN ARBITRARY 10-DEGREE ANGLE OF ATTACK; SUCH AS MIGHT BE ENCOUNTERED DURING TAKEOFF OR SHARP MANEUVERING IN FLIGHT.

THE CASTING WILL BE MODELED USING TRIANGULAR PLATE ELEMENTS FOR THE BASIC CASTING WALLS AND TRIDIMENSIONAL ELEMENTS FOR THE HOLD-DOWN BOSSSES. THE CASTING MATERIAL IS ALUMINUM ALLOY A356-T6.

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET    98                    |

 ANTENNA ATTACHMENTS

FWD

Y

3.50  
2.80  
2.63  
2.25

1.31

| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |

21.56  
21.25  
20.25  
19.31  
18.56  
  
16.37  
15.63  
14.63  
13.89  
13.00  
12.00  
11.41  
  
09.38  
07.41  
06.58  
05.58  
04.74  
03.76  
02.76  
02.06  
00.94  
00.00  
-0.75  
-1.06

GENERAL OUTLINE  
OF THE  
ANTENNA MOUNT

**2.0--LOCATION OF THE NODE POINTS**

UNITS INCHES,DEGREES

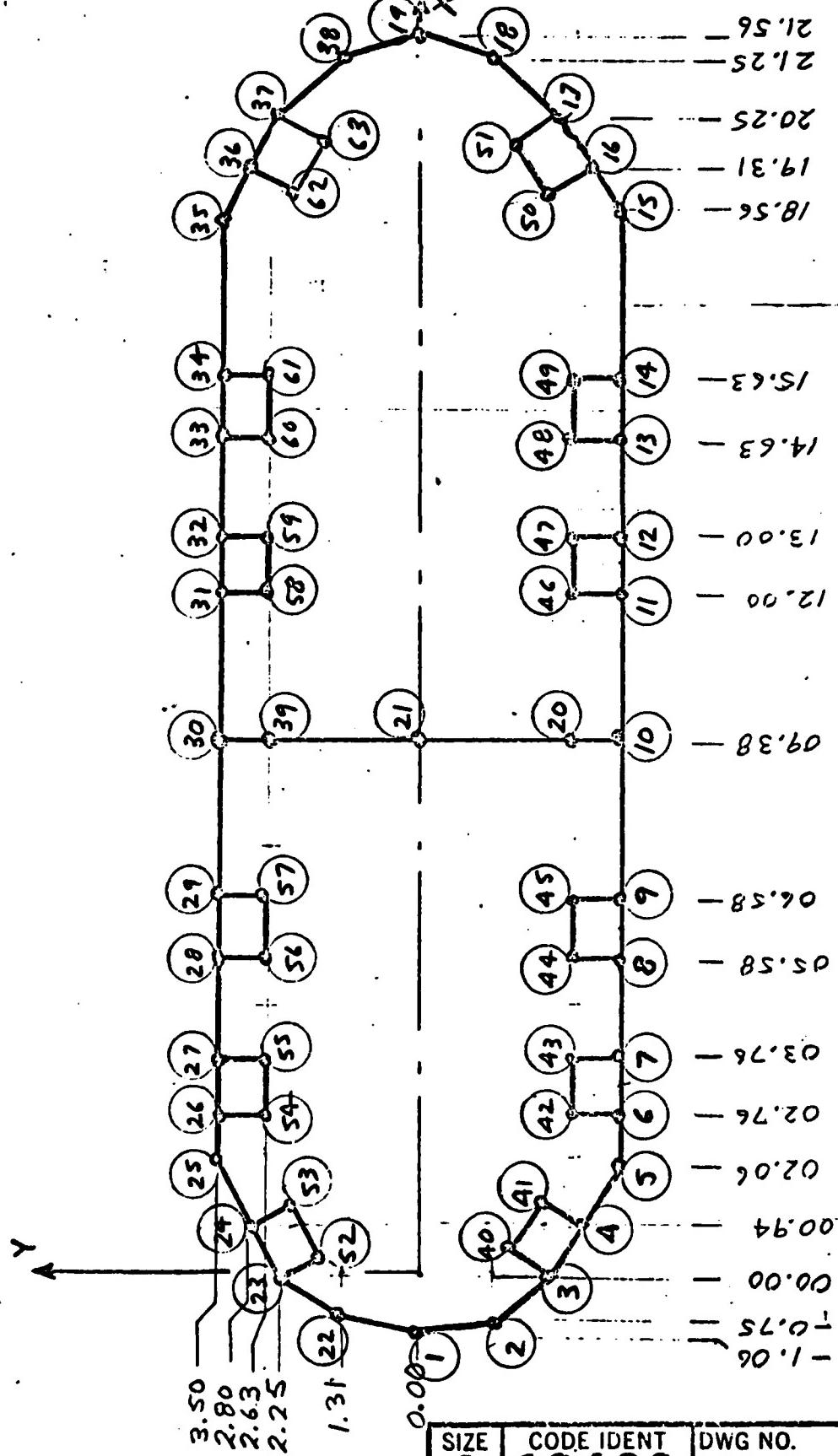
**2.1--LOWER SLOPING PLANE**

**NODE COORDINATES**

|    | X     | Y     | Z    |
|----|-------|-------|------|
| 1  | -1.06 | +0.00 | .13  |
| 2  | -0.75 | -1.31 | -.09 |
| 3  | 00.00 | -2.25 | 0.00 |
| 4  | 00.94 | -2.88 | 0.12 |
| 5  | 02.06 | -3.50 | 0.25 |
| 6  | 02.76 | -3.50 | 0.34 |
| 7  | 03.76 | -3.50 | 0.46 |
| 8  | 05.58 | -3.50 | 0.69 |
| 9  | 06.58 | -3.50 | 0.81 |
| 10 | 09.38 | -3.50 | 1.15 |
| 11 | 12.00 | -3.50 | 1.47 |
| 12 | 13.00 | -3.50 | 1.60 |
| 13 | 14.63 | -3.50 | 1.80 |
| 14 | 15.63 | -3.50 | 1.92 |
| 15 | 18.56 | -3.50 | 2.28 |
| 16 | 19.31 | -3.00 | 2.37 |
| 17 | 20.25 | -2.38 | 2.49 |
| 18 | 21.25 | -1.31 | 2.61 |
| 19 | 21.56 | +0.00 | 2.65 |
| 20 | 09.38 | -2.63 | 1.15 |
| 21 | 09.38 | +0.00 | 1.15 |
| 22 | -0.75 | +1.31 | -.09 |
| 23 | 00.00 | +2.25 | 0.00 |
| 24 | 00.94 | +2.88 | 0.12 |
| 25 | 02.06 | +3.50 | 0.25 |
| 26 | 02.76 | +3.50 | 0.34 |
| 27 | 03.76 | +3.50 | 0.46 |
| 28 | 05.58 | +3.50 | 0.69 |
| 29 | 06.58 | +3.50 | 0.81 |
| 30 | 09.38 | +3.50 | 1.15 |
| 31 | 12.00 | +3.50 | 1.47 |
| 32 | 13.00 | +3.50 | 1.60 |
| 33 | 14.63 | +3.50 | 1.80 |
| 34 | 15.63 | +3.50 | 1.92 |
| 35 | 16.56 | +3.50 | 2.28 |
| 36 | 19.31 | +3.00 | 2.37 |
| 37 | 20.25 | +2.38 | 2.49 |
| 38 | 21.25 | +1.31 | 2.61 |
| 39 | 09.38 | +2.63 | 1.15 |
| 40 | 00.50 | -1.50 | 0.06 |
| 41 | 01.38 | -2.13 | 0.17 |
| 42 | 02.76 | -2.63 | 0.34 |
| 43 | 03.76 | -2.63 | 0.46 |

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET<br>100            |

LOWER SLOPING PLANE



|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | 101          |

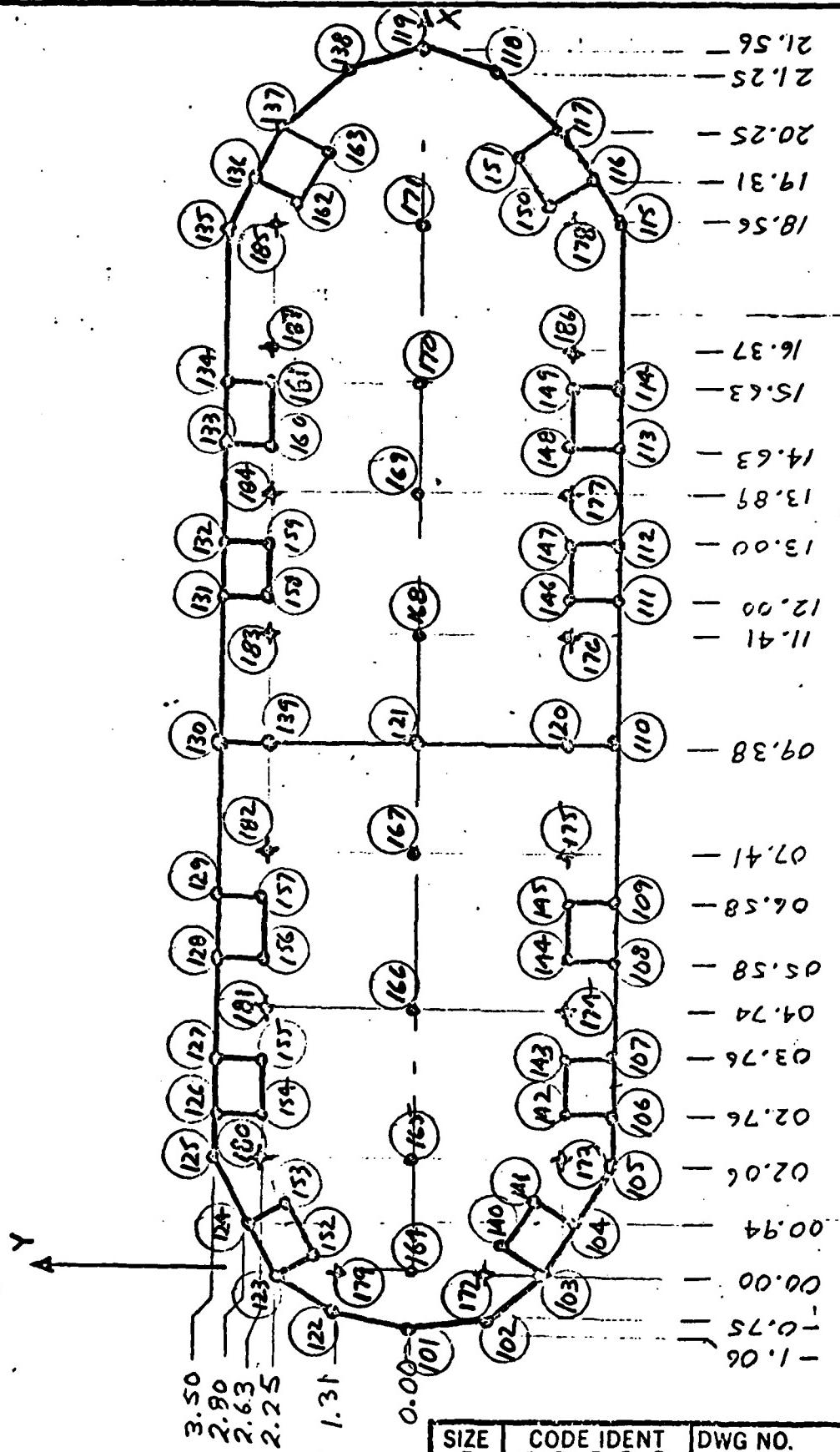
**2.2--UPPER PLANE**

**NODE COORDINATES**

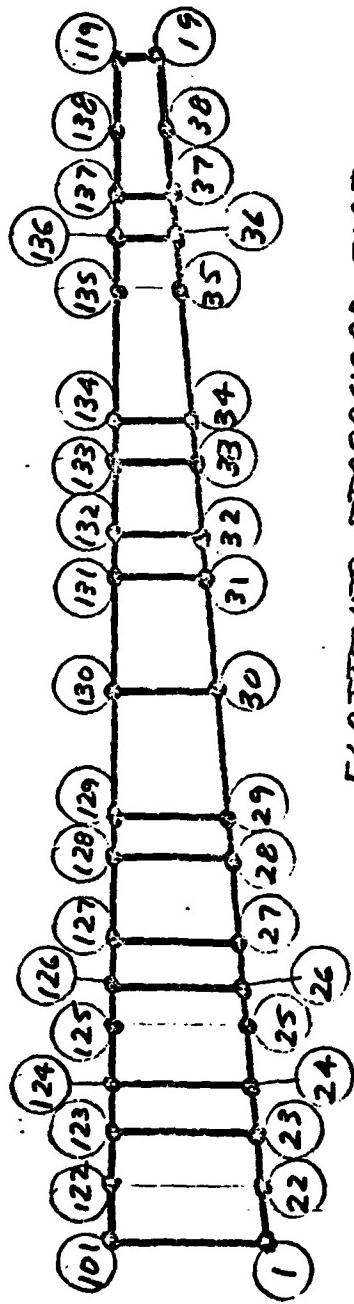
| NODE | X     | Y     | Z     |      |
|------|-------|-------|-------|------|
| 101  | -1.06 | +0.00 | 3.20  |      |
| 102  | -0.75 | -1.31 | 3.20  |      |
| 103  | 00.00 | -2.25 | 3.20  |      |
| 104  | 00.94 | -2.88 | 3.20  |      |
| 105  | 02.06 | -3.50 | 3.20  |      |
| 106  | 02.76 | -3.50 | 3.20  |      |
| 107  | 03.76 | -3.50 | 3.20  |      |
| 108  | 05.58 | -3.50 | 3.20  |      |
| 109  | 06.58 | -3.50 | 3.20  |      |
| 110  | 09.08 | -3.50 | 3.20  |      |
| 111  | 12.00 | -3.50 | 3.20  |      |
| 112  | 13.00 | -3.50 | 3.20  |      |
| 113  | 14.63 | -3.50 | 3.20  |      |
| 114  | 15.63 | -3.50 | 3.20  |      |
| 115  | 18.56 | -3.50 | 3.20  |      |
| 116  | 19.51 | -3.00 | 3.20  |      |
| 117  | 20.25 | -2.38 | 3.20  |      |
| 118  | 21.25 | -1.31 | 3.20  |      |
| 119  | 21.56 | +0.00 | 3.20  |      |
| 120  | 09.58 | -2.63 | 3.20  |      |
| 121  | 09.58 | +0.00 | 3.20  |      |
| 122  | -0.75 | +1.31 | 3.20  |      |
| 123  | 00.00 | +2.25 | 3.20  |      |
| 124  | 00.94 | +2.88 | 3.20  |      |
| 125  | 02.06 | +3.50 | 3.20  |      |
| 126  | 02.76 | +3.50 | 3.20  |      |
| 127  | 03.76 | +3.50 | 3.20  |      |
| 128  | 05.58 | +3.50 | 3.20  |      |
| 129  | 06.58 | +3.50 | 3.20  |      |
| 130  | 09.08 | +3.50 | 3.20  |      |
| 131  | 12.00 | +3.50 | 3.20  |      |
| 132  | 13.00 | +3.50 | 3.20  |      |
| 133  | 14.63 | +3.50 | 3.20  |      |
| 134  | 15.63 | +3.50 | 3.20  |      |
| 135  | 16.56 | +3.50 | 3.20  |      |
| 136  | 19.51 | +3.00 | 3.20  |      |
| 137  | 20.25 | +2.38 | 3.20  |      |
| 138  | 21.25 | +1.31 | 3.20  |      |
| 139  | 09.08 | +2.63 | 3.20  |      |
| 140  | 00.50 | -1.50 | 3.20  |      |
| 141  | 01.58 | -2.13 | 3.20  |      |
| 142  | 02.76 | -2.63 | 3.20  |      |
| 143  | 03.76 | -2.63 | 3.20  |      |
| 144  | 05.58 | -2.63 | 3.20  |      |
| 145  | 06.58 | -2.63 | 3.20  |      |
| 146  | 12.00 | -2.63 | 3.20  |      |
| 147  | 13.00 | -2.63 | 3.20  |      |
| 148  | 14.63 | -2.63 | 3.20  |      |
| 149  | 15.63 | -2.63 | 3.20  |      |
|      | 150   | 18.88 | -2.25 | 3.20 |
|      | 151   | 19.75 | -1.69 | 3.20 |
|      | 152   | 00.50 | +1.50 | 3.20 |
|      | 153   | 01.58 | +2.13 | 3.20 |
|      | 154   | 02.76 | +2.63 | 3.20 |
|      | 155   | 03.76 | +2.63 | 3.20 |
|      | 156   | 05.58 | +2.63 | 3.20 |
|      | 157   | 06.58 | +2.63 | 3.20 |
|      | 158   | 12.00 | +2.63 | 3.20 |
|      | 159   | 13.00 | +2.63 | 3.20 |
|      | 160   | 14.63 | +2.63 | 3.20 |
|      | 161   | 15.63 | +2.63 | 3.20 |
|      | 162   | 18.88 | +2.25 | 3.20 |
|      | 163   | 19.75 | +1.69 | 3.20 |
|      | 165   | 02.06 | +0.00 | 3.20 |
|      | 164   | 00.00 | +0.00 | 3.20 |
|      | 166   | 04.74 | +0.00 | 3.20 |
|      | 167   | 07.41 | +0.00 | 3.20 |
|      | 168   | 11.41 | +0.00 | 3.20 |
|      | 169   | 13.89 | +0.00 | 3.20 |
|      | 170   | 15.63 | +0.00 | 3.20 |
|      | 171   | 18.56 | +0.00 | 3.20 |
|      | 172   | 00.00 | -1.31 | 3.20 |
|      | 173   | 02.06 | -2.63 | 3.20 |
|      | 174   | 04.74 | -2.63 | 3.20 |
|      | 175   | 07.41 | -2.63 | 3.20 |
|      | 176   | 11.41 | -2.63 | 3.20 |
|      | 177   | 13.89 | -2.63 | 3.20 |
|      | 178   | 18.56 | -2.63 | 3.20 |
|      | 179   | 00.00 | +1.31 | 3.20 |
|      | 180   | 02.06 | +2.63 | 3.20 |
|      | 181   | 04.74 | +2.63 | 3.20 |
|      | 182   | 07.41 | +2.63 | 3.20 |
|      | 183   | 11.41 | +2.63 | 3.20 |
|      | 184   | 13.89 | +2.63 | 3.20 |
|      | 185   | 18.56 | +2.63 | 3.20 |
|      | 186   | 16.57 | -2.63 | 3.20 |
|      | 187   | 16.57 | +2.63 | 3.20 |

|                  |                            |              |     |
|------------------|----------------------------|--------------|-----|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.      |     |
|                  |                            | 649-2924-001 |     |
| SCALE            | REV                        | SHEET        | 102 |

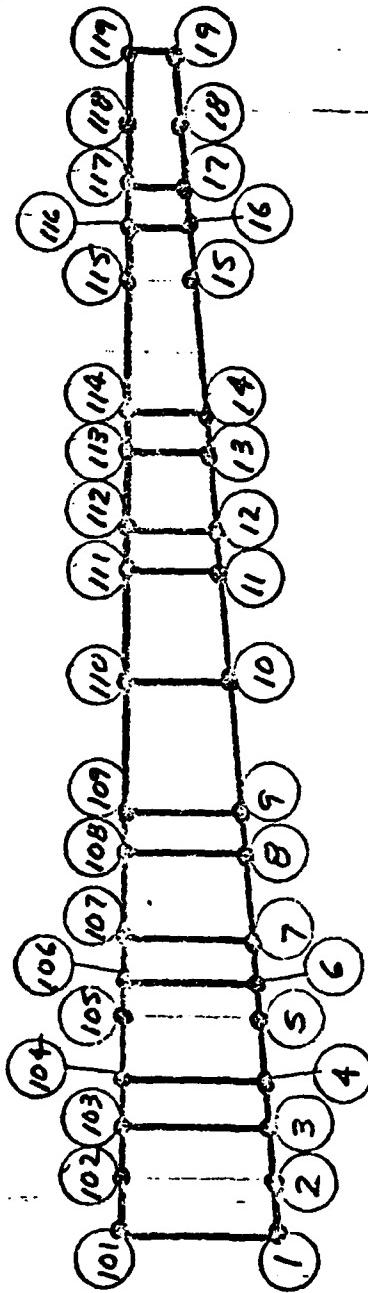
UPPER HORIZ. PLANE



| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | 103          |



FLATTENED STARBOARD SIDE



FLATTENED PORT SIDE

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | 104          |

**2.3--SUPPORT NODES**

**NODE COORDINATES**

|     | X     | Y     | Z    |         |
|-----|-------|-------|------|---------|
| 220 | 09.58 | -2.63 | 0.15 | SUPPORT |
| 221 | 09.58 | +0.00 | 0.15 | SUPPORT |
| 239 | 09.58 | +2.63 | 0.15 | SUPPORT |
| 240 | 00.50 | -1.50 | -.94 | SUPPORT |
| 241 | 01.38 | -2.13 | -.83 | SUPPORT |
| 242 | 02.76 | -2.63 | -.66 | SUPPORT |
| 243 | 03.76 | -2.63 | -.54 | SUPPORT |
| 244 | 05.58 | -2.63 | -.31 | SUPPORT |
| 245 | 06.58 | -2.63 | -.19 | SUPPORT |
| 246 | 12.00 | -2.63 | 0.47 | SUPPORT |
| 247 | 13.00 | -2.63 | 0.60 | SUPPORT |
| 248 | 14.63 | -2.63 | 0.80 | SUPPORT |
| 249 | 15.63 | -2.63 | 0.92 | SUPPORT |
| 250 | 18.88 | -2.25 | 1.32 | SUPPORT |
| 251 | 19.75 | -1.69 | 1.42 | SUPPORT |
| 252 | 00.50 | +1.50 | -.94 | SUPPORT |
| 253 | 01.38 | +2.13 | -.83 | SUPPORT |
| 254 | 02.76 | +2.63 | -.66 | SUPPORT |
| 255 | 03.76 | +2.63 | -.54 | SUPPORT |
| 256 | 05.58 | +2.63 | -.31 | SUPPORT |
| 257 | 06.58 | +2.63 | -.19 | SUPPORT |
| 258 | 12.00 | +2.63 | 0.47 | SUPPORT |
| 259 | 13.00 | +2.63 | 0.60 | SUPPORT |
| 260 | 14.63 | +2.63 | 0.80 | SUPPORT |
| 261 | 15.63 | +2.63 | 0.92 | SUPPORT |
| 262 | 18.88 | +2.25 | 1.32 | SUPPORT |
| 263 | 19.75 | +1.69 | 1.42 | SUPPORT |

**NODE RELEASES**

|            |       |   |
|------------|-------|---|
| 220, 239   | FORCE | Y |
| 240 TO 263 | FORCE | Y |

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET<br><b>105</b>            |

**3.0--LOCATION OF THE FINITE ELEMENTS**

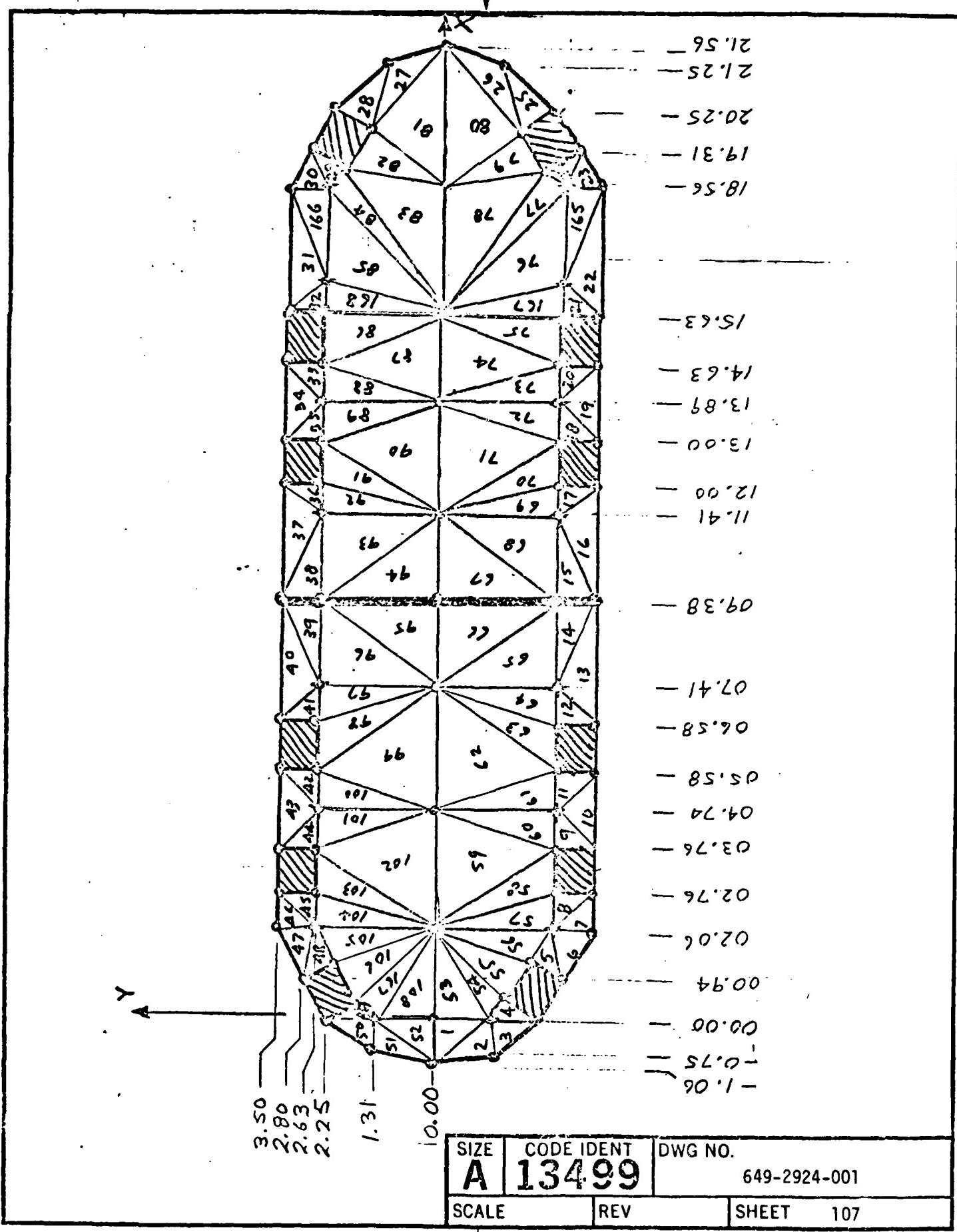
**3.1--UPPER HORIZONTAL SURFACE**

TYPE BENDING

**ELEMENT INCIDENCES**

|     |     |     |     |
|-----|-----|-----|-----|
| 1   | 101 | 172 | 164 |
| 2   | 172 | 101 | 102 |
| 3   | 102 | 103 | 172 |
| 4   | 172 | 103 | 140 |
| 5   | 104 | 173 | 141 |
| 6   | 173 | 104 | 105 |
| 7   | 106 | 173 | 105 |
| 8   | 173 | 106 | 142 |
| 9   | 107 | 174 | 143 |
| 10  | 107 | 108 | 174 |
| 11  | 174 | 108 | 144 |
| 12  | 109 | 175 | 145 |
| 13  | 109 | 110 | 175 |
| 14  | 175 | 110 | 120 |
| 15  | 110 | 176 | 120 |
| 16  | 110 | 111 | 176 |
| 17  | 176 | 111 | 146 |
| 18  | 112 | 177 | 147 |
| 19  | 112 | 113 | 177 |
| 20  | 177 | 113 | 148 |
| 21  | 114 | 186 | 149 |
| 22  | 114 | 115 | 186 |
| 165 | 186 | 115 | 178 |
| 23  | 115 | 116 | 178 |
| 24  | 178 | 116 | 150 |
| 25  | 118 | 151 | 117 |
| 26  | 119 | 151 | 118 |
| 27  | 163 | 119 | 138 |
| 28  | 138 | 137 | 163 |
| 29  | 136 | 185 | 162 |
| 30  | 185 | 136 | 135 |
| 31  | 135 | 134 | 187 |
| 32  | 187 | 134 | 161 |
| 166 | 135 | 187 | 185 |
| 33  | 133 | 184 | 160 |
| 34  | 133 | 132 | 184 |
| 35  | 184 | 132 | 159 |
| 36  | 131 | 183 | 158 |
| 37  | 131 | 130 | 183 |
| 38  | 183 | 130 | 139 |
| 39  | 130 | 182 | 139 |
| 40  | 130 | 129 | 157 |
| 41  | 182 | 129 | 157 |
| 42  | 128 | 181 | 156 |

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 106               |



|     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 43  | 128 | 127 | 181 | 78  | 170 | 150 | 171 |
| 44  | 181 | 127 | 155 | 79  | 171 | 150 | 151 |
| 45  | 126 | 180 | 154 | 80  | 119 | 171 | 151 |
| 46  | 180 | 126 | 125 | 81  | 171 | 119 | 163 |
| 47  | 125 | 124 | 180 | 82  | 162 | 171 | 163 |
| 48  | 180 | 124 | 153 | 83  | 162 | 170 | 171 |
| 49  | 123 | 179 | 152 | 84  | 170 | 162 | 185 |
| 50  | 123 | 122 | 179 | 85  | 170 | 185 | 187 |
| 51  | 101 | 179 | 122 | 168 | 170 | 187 | 161 |
| 52  | 179 | 101 | 164 | 86  | 160 | 170 | 161 |
| 53  | 172 | 165 | 164 | 87  | 170 | 160 | 169 |
| 54  | 165 | 172 | 140 | 88  | 169 | 160 | 184 |
| 55  | 141 | 165 | 140 | 89  | 159 | 169 | 184 |
| 56  | 173 | 165 | 141 | 90  | 159 | 168 | 169 |
| 57  | 142 | 165 | 173 | 91  | 168 | 159 | 158 |
| 58  | 143 | 165 | 142 | 92  | 168 | 158 | 183 |
| 59  | 165 | 143 | 166 | 93  | 139 | 168 | 183 |
| 60  | 166 | 143 | 174 | 94  | 168 | 139 | 131 |
| 61  | 144 | 166 | 174 | 95  | 139 | 167 | 121 |
| 62  | 144 | 167 | 166 | 96  | 167 | 139 | 182 |
| 63  | 167 | 144 | 145 | 97  | 157 | 167 | 182 |
| 64  | 167 | 145 | 175 | 98  | 156 | 167 | 157 |
| 65  | 120 | 167 | 175 | 99  | 167 | 156 | 166 |
| 66  | 167 | 120 | 121 | 100 | 166 | 156 | 181 |
| 67  | 120 | 168 | 121 | 101 | 155 | 166 | 156 |
| 68  | 168 | 120 | 176 | 102 | 155 | 165 | 166 |
| 69  | 146 | 168 | 176 | 103 | 165 | 155 | 154 |
| 70  | 147 | 168 | 146 | 104 | 165 | 154 | 180 |
| 71  | 168 | 147 | 169 | 105 | 165 | 180 | 155 |
| 72  | 169 | 147 | 177 | 106 | 152 | 165 | 153 |
| 73  | 148 | 169 | 177 | 107 | 165 | 152 | 179 |
| 74  | 169 | 148 | 170 | 108 | 165 | 179 | 164 |
| 75  | 170 | 148 | 149 |     |     |     |     |
| 167 | 186 | 170 | 149 |     |     |     |     |
| 76  | 178 | 170 | 186 |     |     |     |     |
| 77  | 170 | 178 | 150 |     |     |     |     |

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 108               |

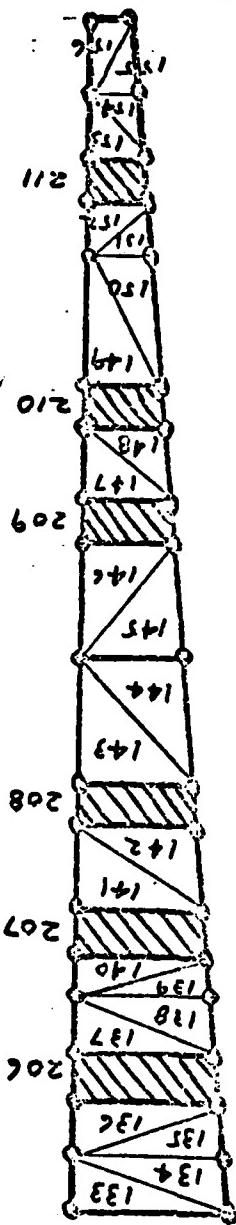
**3.2--VERTICAL SIDE ELEMENTS**

TYPE BENDING

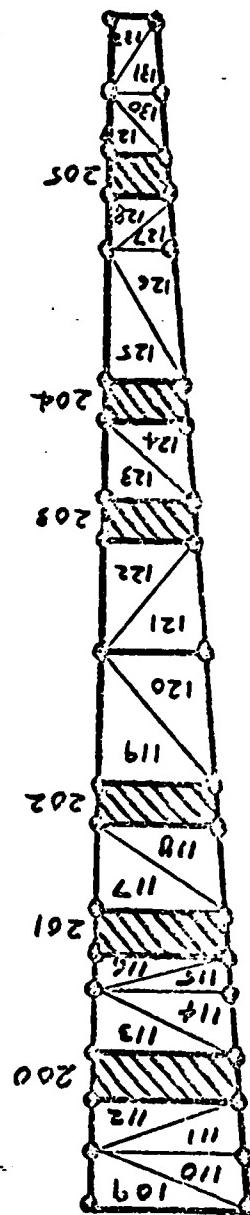
ELEMENT INCIDENCES

|     |     |     |     |     |     |     |     |
|-----|-----|-----|-----|-----|-----|-----|-----|
| 109 | 1   | 102 | 101 | 133 | 1   | 122 | 101 |
| 110 | 102 | 1   | 2   | 134 | 122 | 1   | 22  |
| 111 | 3   | 102 | 2   | 135 | 23  | 122 | 22  |
| 112 | 102 | 3   | 103 | 136 | 122 | 23  | 123 |
| 113 | 4   | 105 | 104 | 137 | 24  | 125 | 124 |
| 114 | 105 | 4   | 5   | 138 | 125 | 24  | 25  |
| 115 | 6   | 105 | 5   | 139 | 26  | 125 | 25  |
| 116 | 105 | 6   | 106 | 140 | 125 | 26  | 126 |
| 117 | 7   | 108 | 107 | 141 | 27  | 128 | 127 |
| 118 | 108 | 7   | 8   | 142 | 128 | 27  | 28  |
| 119 | 9   | 110 | 109 | 143 | 29  | 130 | 129 |
| 120 | 110 | 9   | 10  | 144 | 130 | 29  | 30  |
| 121 | 11  | 110 | 10  | 145 | 31  | 130 | 30  |
| 122 | 110 | 11  | 111 | 146 | 130 | 31  | 131 |
| 123 | 12  | 113 | 112 | 147 | 32  | 133 | 132 |
| 124 | 113 | 12  | 13  | 148 | 133 | 32  | 33  |
| 125 | 14  | 115 | 114 | 149 | 34  | 135 | 134 |
| 126 | 115 | 14  | 15  | 150 | 135 | 34  | 35  |
| 127 | 16  | 115 | 15  | 151 | 36  | 135 | 35  |
| 128 | 115 | 16  | 116 | 152 | 135 | 36  | 136 |
| 129 | 17  | 118 | 117 | 153 | 37  | 138 | 137 |
| 130 | 118 | 17  | 18  | 154 | 138 | 37  | 38  |
| 131 | 19  | 118 | 18  | 155 | 19  | 138 | 38  |
| 132 | 118 | 19  | 119 | 156 | 138 | 19  | 119 |

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET<br>109            |



FLATTENED STARBOARD SIDE



|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 110               |

**3.3--CAST BOSSES**

**TYPE TRIUMENSIONAL**

**ELEMENT      INCIDENCES**

|     |    |    |     |     |    |    |     |     |
|-----|----|----|-----|-----|----|----|-----|-----|
| 200 | 3  | 4  | 104 | 103 | 40 | 41 | 141 | 140 |
| 201 | 6  | 7  | 107 | 106 | 42 | 43 | 143 | 142 |
| 202 | 8  | 9  | 109 | 108 | 44 | 45 | 145 | 144 |
| 203 | 11 | 12 | 112 | 111 | 46 | 47 | 147 | 146 |
| 204 | 13 | 14 | 114 | 113 | 48 | 49 | 149 | 148 |
| 205 | 16 | 17 | 117 | 116 | 50 | 51 | 151 | 150 |
| 206 | 52 | 53 | 153 | 152 | 23 | 24 | 124 | 123 |
| 207 | 54 | 55 | 155 | 154 | 26 | 27 | 127 | 126 |
| 208 | 56 | 57 | 157 | 156 | 28 | 29 | 129 | 128 |
| 209 | 58 | 59 | 159 | 158 | 31 | 32 | 132 | 131 |
| 210 | 60 | 61 | 161 | 160 | 33 | 34 | 134 | 133 |
| 211 | 62 | 63 | 163 | 162 | 36 | 37 | 137 | 136 |

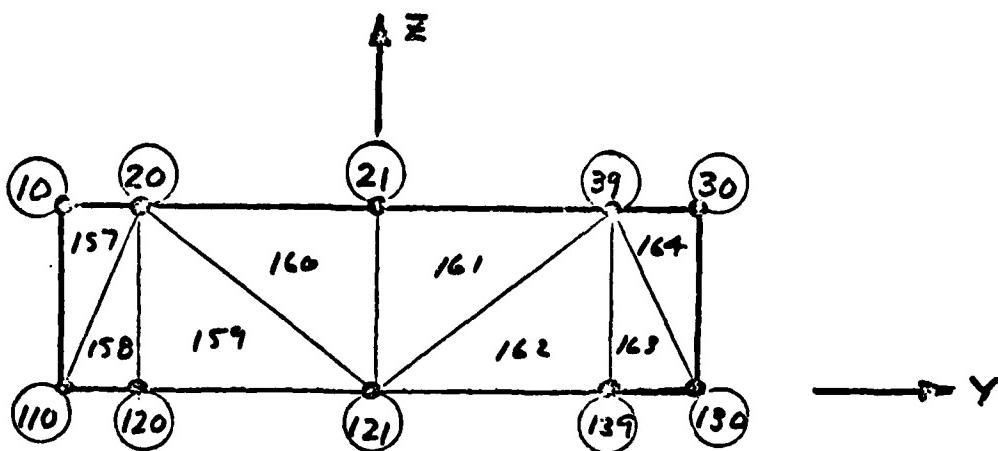
|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 111               |

**3.4--TRANSVERSE KIB**

TYPE BENDING

ELEMENT INCIDENCES

|     |     |     |     |
|-----|-----|-----|-----|
| 157 | 110 | 20  | 10  |
| 158 | 20  | 110 | 120 |
| 159 | 121 | 20  | 120 |
| 160 | 20  | 121 | 21  |
| 161 | 121 | 39  | 21  |
| 162 | 39  | 121 | 139 |
| 163 | 130 | 39  | 139 |
| 164 | 39  | 130 | 30  |



**TRANSVERSE RIB**

(X = 09.38)

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 112               |

**3.5--SUPPORT MEMBERS**

**TYPE    SPACE FRAME**

**MEMBER    INCIDENCES**

|     |     |    |
|-----|-----|----|
| 300 | 220 | 20 |
| 301 | 221 | 21 |
| 302 | 239 | 39 |
| 303 | 240 | 40 |
| 304 | 241 | 41 |
| 305 | 242 | 42 |
| 306 | 243 | 43 |
| 307 | 244 | 44 |
| 308 | 245 | 45 |
| 309 | 246 | 46 |
| 310 | 247 | 47 |
| 311 | 248 | 48 |
| 312 | 249 | 49 |
| 313 | 250 | 50 |
| 314 | 251 | 51 |
| 315 | 252 | 52 |
| 316 | 253 | 53 |
| 317 | 254 | 54 |
| 318 | 255 | 55 |
| 319 | 256 | 56 |
| 320 | 257 | 57 |
| 321 | 258 | 58 |
| 322 | 259 | 59 |
| 323 | 260 | 60 |
| 324 | 261 | 61 |
| 325 | 262 | 62 |
| 326 | 263 | 63 |

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | 113          |

**3.6--DUMMY FRAMING MEMBERS**

IN ORDER TO HAVE COMPATIBILITY OF DEGREES-OF-FREEDOM AT ALL THE NODE POINTS, THIN DUMMY MEMBERS WILL BE USED TO MAKE UP A VIRTUAL FRAME HAVING INSIGNIFICANT STIFFNESS.

**TYPE SPACE FRAME**

**MEMBER INCIDENCES**

|     |          |    |     |     |     |     |    |     |
|-----|----------|----|-----|-----|-----|-----|----|-----|
| 400 | 1        | 2  | 437 | 101 | 102 |     |    |     |
| 401 | 2        | 3  | 438 | 102 | 103 |     |    |     |
| 402 | 3        | 4  | 439 | 103 | 104 |     |    |     |
| 403 | 4        | 5  | 440 | 104 | 105 | 473 | 1  | 101 |
| 404 | 5        | 6  | 441 | 105 | 106 | 474 | 2  | 102 |
| 405 | 6        | 7  | 442 | 106 | 107 | 475 | 5  | 105 |
| 406 | 7        | 8  | 443 | 107 | 108 | 476 | 10 | 110 |
| 407 | 8        | 9  | 444 | 108 | 109 | 477 | 15 | 115 |
| 408 | 9        | 10 | 445 | 109 | 110 | 478 | 18 | 118 |
| 409 | 10       | 11 | 446 | 110 | 111 | 479 | 19 | 119 |
| 410 | 11       | 12 | 447 | 111 | 112 | 480 | 22 | 122 |
| 411 | 12       | 13 | 448 | 112 | 113 | 481 | 25 | 125 |
| 412 | 13       | 14 | 449 | 113 | 114 | 482 | 30 | 130 |
| 413 | 14       | 15 | 450 | 114 | 115 | 483 | 35 | 135 |
| 414 | NOT USED |    | 451 | 115 | 116 | 484 | 38 | 138 |
| 415 | 15       | 16 | 452 | 116 | 117 |     |    |     |
| 416 | 16       | 17 | 453 | 117 | 118 |     |    |     |
| 417 | 17       | 18 | 454 | 118 | 119 |     |    |     |
| 418 | 18       | 19 | 455 | 101 | 122 |     |    |     |
| 419 | 1        | 22 | 456 | 122 | 123 |     |    |     |
| 420 | 22       | 23 | 457 | 123 | 124 |     |    |     |
| 421 | 23       | 24 | 458 | 124 | 125 |     |    |     |
| 422 | 24       | 25 | 459 | 125 | 126 |     |    |     |
| 423 | 25       | 26 | 460 | 126 | 127 |     |    |     |
| 424 | 26       | 27 | 461 | 127 | 128 |     |    |     |
| 425 | 27       | 28 | 462 | 128 | 129 |     |    |     |
| 426 | 28       | 29 | 463 | 129 | 130 |     |    |     |
| 427 | 29       | 30 | 464 | 130 | 131 |     |    |     |
| 428 | 30       | 31 | 465 | 131 | 132 |     |    |     |
| 429 | 31       | 32 | 466 | 132 | 133 |     |    |     |
| 430 | 32       | 33 | 467 | 133 | 134 |     |    |     |
| 431 | 33       | 34 | 468 | 134 | 135 |     |    |     |
| 432 | 34       | 35 | 469 | 135 | 136 |     |    |     |
| 433 | 35       | 36 | 470 | 136 | 137 |     |    |     |
| 434 | 36       | 37 | 471 | 137 | 138 |     |    |     |
| 435 | 37       | 38 | 472 | 138 | 119 |     |    |     |
| 436 | 38       | 29 |     |     |     |     |    |     |

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | 114          |

4.0--PROPERTIES OF THE STRUCTURAL COMPONENTS

ELEMENT      PROPERTIES

|            |      |           |           |      |
|------------|------|-----------|-----------|------|
| 1 TO 108   | TYPE | 'SBCT'    | THICKNESS | .190 |
| 109 TO 114 | TYPE | 'SBCT'    | THICKNESS | .375 |
| 115 TO 128 | TYPE | 'SBCT'    | THICKNESS | .190 |
| 129 TO 132 | TYPE | 'SBCT'    | THICKNESS | 1.25 |
| 133 TO 138 | TYPE | 'SBCT'    | THICKNESS | .375 |
| 139 TO 152 | TYPE | 'SBCT'    | THICKNESS | .190 |
| 153 TO 156 | TYPE | 'SBCT'    | THICKNESS | 1.25 |
| 157 TO 164 | TYPE | 'SBCT'    | THICKNESS | 1.00 |
| 165 TO 168 | TYPE | 'SBCT'    | THICKNESS | .190 |
| 200 TO 211 | TYPE | 'IPLSCSH' |           |      |

MEMBER      PROPERTIES

|            |          |          |          |          |          |          |
|------------|----------|----------|----------|----------|----------|----------|
| 300 TO 326 | AX .0228 | IX .0002 | IY .0001 | SY .0007 | IZ .0001 | SZ .0007 |
| 400 TO 413 | AX .0361 | IX .0002 | IY .0001 | IZ .0001 |          |          |
| 415 TO 454 | AX .0561 | IX .0002 | IY .0001 | IZ .0001 |          |          |

CONSTANTS

|             |     |
|-------------|-----|
| E 1.00E7    | ALL |
| G 3.00E6    | ALL |
| POISSON .53 | ALL |

|             |            |
|-------------|------------|
| E 2.90E7    | 300 TO 326 |
| G 1.20E7    | 300 TO 326 |
| POISSON .50 | 300 TO 326 |

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 115               |

5.0--LOADING OF THE CASTING STRUCTURE

THE LOADING TO BE APPLIED IS FOR THE SEA LEVEL FLIGHT AT THE MAXIMUM VELOCITY OF 380-KNOTS. THIS CONDITION RESULTS IN THE WORST-CASE DYNAMIC LOADING.

DRAG FORCE 90.90-LB.

LIFT FORCE 338.0-LB.

MOMENT 2360 IN.-LB.

LOADING "DRAG"

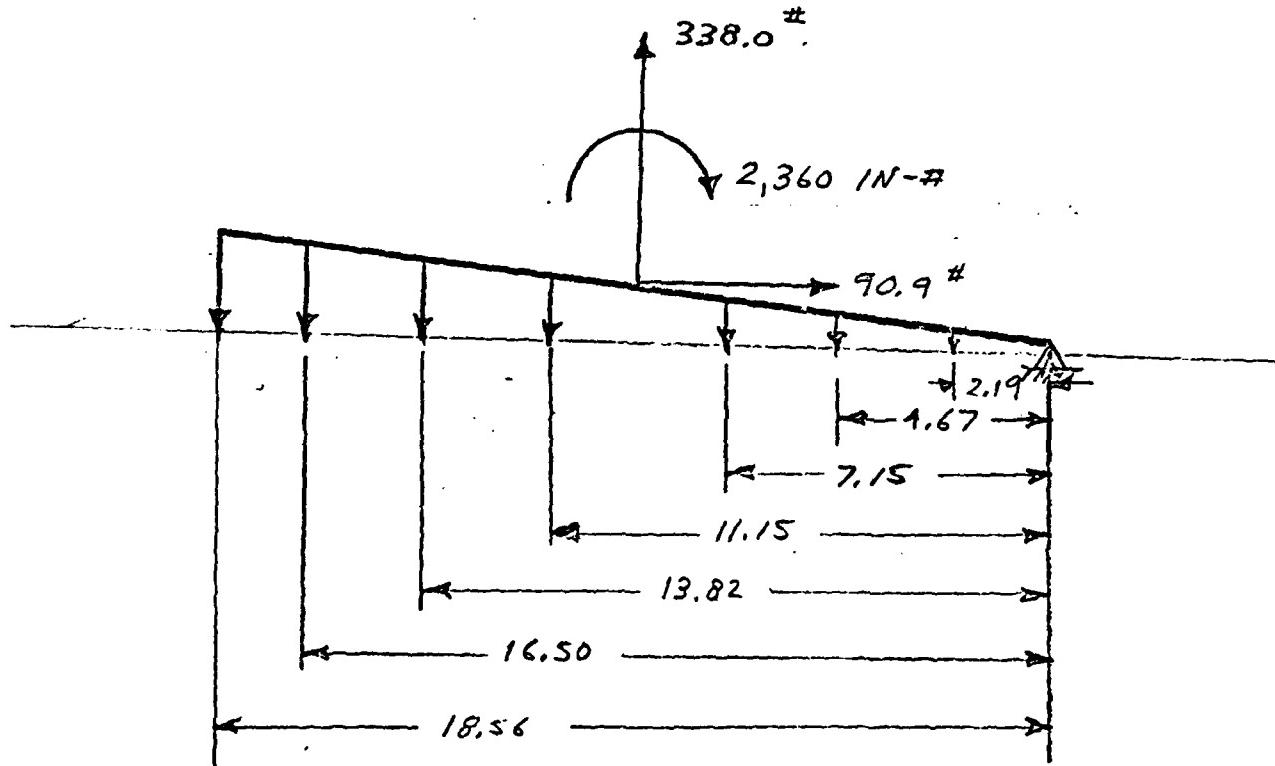
NODE LOADS

|         |               |                |
|---------|---------------|----------------|
| 172.179 | FORCE X +5.68 | FORCE Z +42.82 |
| 173.180 | FORCE X +5.68 | FORCE Z +40.41 |
| 174.181 | FORCE X +5.68 | FORCE Z +37.28 |
| 175.182 | FORCE X +5.68 | FORCE Z +34.16 |
| 176.183 | FORCE X +5.68 | FORCE Z +29.49 |
| 177.184 | FORCE X +5.68 | FORCE Z +26.59 |
| 186.187 | FORCE X +5.68 | FORCE Z +23.69 |
| 178.185 | FORCE X +5.68 | FORCE Z -65.44 |

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 116               |

## ANTENNA ATTACHMENT LOADS \*

ASSUMPTION: THE ANTENNA STIFFNESS IS OF SUCH MAGNITUDE THAT THE ANTENNA TENDS TO ROTATE AS A RIGID BODY ABOUT ITS AFT EDGE.



### LIFT LOADING

$$\text{EACH NODE } F_Z = + \frac{338.0}{16} = + 21.13$$

### DRAG LOADING

$$\text{EACH NODE } F_X = + \frac{90.9}{16} = + 5.68$$

\* SEE APPENDIX 'A'  
FOR LOAD CALCS.

|                  |                             |                                |
|------------------|-----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>134.99</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                         | SHEET<br>117                   |

MOMENT LOADING

$$M_R = \frac{2F}{18.56} \left[ (18.56)^2 + (16.50)^2 + (13.82)^2 + (11.15)^2 + (7.13)^2 + (4.67)^2 + (2.19)^2 \right]$$

$$= 108.81 F$$

$$F = \frac{2360}{108.81} = +21.69$$

SUMMATION

NODES 172, 179 FORCE X = +5.68

$$\text{FORCE Z} = +21.13 + 21.69 = +42.82$$

NODES 173, 180 FORCE X = +5.68

$$\text{FORCE Z} = +21.13 + \left( \frac{16.50}{18.56} \right) (21.69) = +40.41$$

NODES 174, 181 FORCE X = +5.68

$$\text{FORCE Z} = +21.13 + \left( \frac{13.82}{18.56} \right) (21.69) = +37.28$$

NODES 175, 182 FORCE X = +5.68

$$\text{FORCE Z} = +21.13 + \left( \frac{11.15}{18.56} \right) (21.69) = +34.16$$

NODES 176, 183 FORCE X = +5.68

$$\text{FORCE Z} = +21.13 + \left( \frac{7.15}{18.56} \right) (21.69) = +29.49$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET 118               |

NODES 177, 184 FORCE X = +5.68

$$\text{FORCE } Z = +21.13 + \left( \frac{4.67}{18.56} \right) (21.69) = +26.59$$

NODES 186, 187 FORCE X = +5.68

$$\text{FORCE } Z = +21.13 + \left( \frac{2.19}{18.56} \right) (21.69) = +23.69$$

NODES 178, 185 FORCE X = +5.68

$$\text{FORCE } Z = -234.44 + \frac{338.0}{2}$$

$$= -65.94$$

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET 119               |

**6.0--MISC. ANALYSIS AND EXECUTION STATEMENTS**

STIFFNESS ANALYSIS REDUCE BAND ROOT

UNITS KIPS

OUTPUT DECIMAL 3

LIST FORCES,REACTIONS,STRESSES ALL

FINISH

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 120    |

## 7.0 - RESULTS OF THE COMPUTER ANALYSIS

### 7.1 - STRESSES IN THE FINITE ELEMENTS

#### 7.1.1 - UPPER HORIZ. SURFACE

MAX. SHEAR STRESS = 23.5-PSI IN EL. 25

MAX. DIRECT STRESS = 46.7-PSI IN EL. 24

MAX. BEND. MOMENT = 20.4 IN-LB/IN IN EL. 44

MAX. BENDING STRESS

$$S_B = \frac{6M}{L^2}$$

$$= \frac{(6)(20.4)}{(0.190)^2} = 3,391 \cdot \text{PSI}$$

#### 7.1.2 - VERTICAL SURFACE

MAX. SHEAR STRESS = 51.1-PSI IN EL. 127

MAX. DIRECT STRESS = 132.0-PSI IN EL. 128

MAX. BEND. MOMENT = 4.12 IN-LB/IN IN EL. 134

= 3.12 IN-LB/IN IN EL. 126

= 8.83 IN-LB/IN IN EL. 156

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET<br>121            |

$$\text{MAX. BENDING STRESS} = \frac{(6)(1.12)}{(0.375)^2} = 176 - \text{PSI}$$

$$= \frac{(6)(3.12)}{(0.190)^2} = 519 - \text{PSI}$$

$$= \frac{(6)(8.83)}{(1.25)^2} = 34 - \text{PSI}$$

### 7.1.3 - TRANSVERSE RIB

$$\text{MAX. SHEAR STRESS} = 5.5 - \text{PSI IN EL. 164}$$

$$\text{MAX. DIRECT STRESS} = 10.6 - \text{PSI IN EL. 157}$$

$$\text{MAX. BEND. MOMENT} = 10.1 \text{ IN-LB/IN IN EL. 169}$$

$$\text{MAX. BENDING STRESS} = \frac{(6)(10.1)}{(1.00)^2} = 61 - \text{PSI}$$

### 7.1.4 - HOLD-DOWN BOSSES

$$\text{MAX. SHEAR STRESS} = 903.7 - \text{PSI IN EL. 205}$$

$$\text{MAX. DIRECT STRESS} = 857.0 - \text{PSI IN EL. 211}$$

### 7.1.5 - MARGINS - OF - SAFETY

AL CASTING ALLOY A356-T6

PER QQ-A-601

A CASTING FACTOR OF 2.0 WILL BE USED

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 122    |

FROM MIL-HDBK-5C , TABLE 3.13.S.O(b)

ASSUMING THE LOWEST CLASS CASTING

$$F_{TY} = 22 - \text{ksi}$$

$$F_{SU} = 22 - \text{ksi}$$

$$\text{M.S. (TEENS. YLD)} = \frac{22,000}{(2.0)(3,391)} - 1.0 = + 2.24$$

$$\text{M. S. (SHEAR ULT)} = \frac{22,000}{(2.0)(903.7)} - 1.0 = + 11.2$$

| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | 123          |

7.2 - ATTACHMENT BOLT LOADS

RESULTANT JOINT LOADS - SUPPORTS

| JOINT  |     | FORCES  |         |         |
|--------|-----|---------|---------|---------|
|        |     | X FORCE | Y FORCE | Z FORCE |
| 220    | GLO | -.010   | .000    | -.007   |
| 221    | GLO | -.009   | -.000   | -.007   |
| 239    | GLO | -.011   | .000    | -.007   |
| 240    | GLO | -.001   | .000    | -.038   |
| 241    | GLO | -.002   | .000    | -.034   |
| 242    | GLO | -.003   | .000    | -.028   |
| 243    | GLO | -.003   | .000    | -.016   |
| 244    | GLO | -.003   | .000    | -.028   |
| 245    | GLO | -.003   | .000    | -.012   |
| 246    | GLO | -.001   | .000    | -.022   |
| 247    | GLO | -.001   | .000    | -.010   |
| 248    | GLO | -.002   | .000    | -.015   |
| 249    | GLO | -.002   | .000    | -.007   |
| 250    | GLO | -.004   | .000    | .050    |
| 251    | GLO | -.005   | .000    | .002    |
| 252    | GLO | -.001   | .000    | -.037   |
| 253    | GLO | -.002   | .000    | -.033   |
| 254    | GLO | -.003   | .000    | -.028   |
| 255    | GLO | -.003   | .000    | -.015   |
| 256    | GLO | -.003   | .000    | -.028   |
| 257    | GLO | -.003   | .000    | -.015   |
| 258    | GLO | -.002   | .000    | -.021   |
| 259    | GLO | -.002   | .000    | -.010   |
| 260    | GLO | -.002   | .000    | -.016   |
| 261    | GLO | -.002   | .000    | -.006   |
| 262    | GLO | -.004   | .000    | .054    |
| 263    | GLO | -.005   | .000    | -.003   |
| TOTALS |     | -.091   | -.000   | -.338   |

FROM THE ANALYTICAL MODEL IT CAN BE SEEN  
THAT TWO NODES AT EACH ROSS REPRESENT  
THE TIE-DOWN ARRANGEMENT.

$$\text{MAX. TENSION} = 38 + 34 = 72 \text{ LB}$$

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET<br><b>124</b>            |

AN. 3 BOLTS (10-32)

$$\left. \begin{array}{l} P_s = 2126-\text{LB} \\ P_t = 2259-\text{LB} \end{array} \right\} \text{MIL-HDBK-5C, TABLES 8.1.5(a) & (b)}$$

SINCE THE SHEAR IS INSIGNIFICANT, INTERACTION EQUATIONS WILL NOT BE USED.

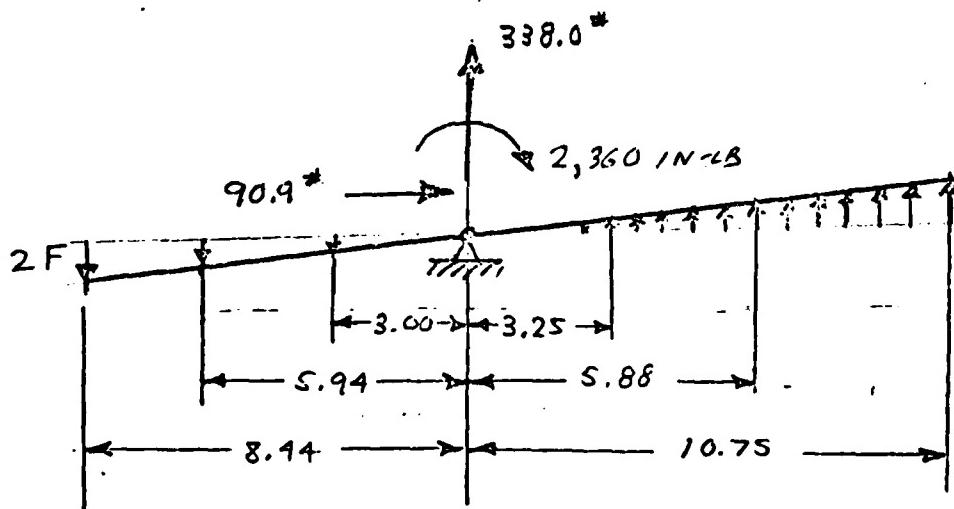
$$\text{M.S. (TENS. UL)} = \frac{2259}{72} - 1.0 = + \underline{\underline{30.4}}$$

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 125    |

## 8.0 - FORCES INDUCED INTO THE AIRCRAFT

### 8.1 - ASSUMPTIONS

- DUE TO THE STIFFNESS OF THE ANTENNA BAYONET, IN COMPARISON TO THE BENDING STIFFNESS OF THE HONEYCOMB PANEL; THE BASE OF THE ANTENNA WILL TEND TO ROTATE AS A RIGID BODY.
- BECAUSE OF THE STIFFNESS OF THE TRANSVERSE A/C STIFFENER, IN COMPARISON TO THE HONEYCOMB PANEL STIFFNESS; THE ANTENNA WILL ROTATE ABOUT THE STIFFENER AND THE ATTACHMENTS TO THE STIFFENER WILL TAKE OUT ALMOST ALL OF THE LIFT FORCE.
- THE AERODYNAMIC FORCES FOR THE WORST-CASE SEA LEVEL FLIGHT WILL CREATE THE MORE SEVERE LOADINGS CONDITION.



|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET 126    |

## 8.2 - REACTION TO THE MOMENT

IN REALITY, THE AFT END OF THE ANTENNA LOADS THE PANEL IN COMPRESSION WITH SOME FORM OF DISTRIBUTED LOADING; PERHAPS TRIANGULAR IN NATURE. THE PROBLEM IS AN INDETERMINATE ONE WHOSE SOLUTION WILL REQUIRE A KNOWLEDGE OF ATTACHMENT BOLT AND PANEL SPRING RATES. TO SIMPLIFY THE SOLUTION, ASSUME EACH PORTION OF THE A/C PANEL ON EACH SIDE OF THE PIVOT LINE REACTS ONE-HALF OF THE MOMENT.

$$2 \left[ \frac{F}{8.44} \left( \overline{8.14}^2 + \overline{5.94}^2 + \overline{3.00}^2 \right) \right] = \frac{1}{2} (2360)$$

$$F = 13.11-\text{LB TENSION}$$

## 8.3 - REACTION TO THE FORCES

ASSUME ALL THE LIFT FORCES IS TAKEN IN THE ATTACHMENTS AT THE TRANSVERSE STIFFENER.

$$F = \frac{1}{3} (338.0) = 112.7-\text{LB TENSION}$$

ASSUME ONLY ONE-HALF OF THE ATTACHMENTS TAKE OUT THE DRAG FORCE

$$F = \frac{1}{6} (90.9) = 15.2-\text{LB SHEAR}$$

|           |                     |                         |
|-----------|---------------------|-------------------------|
| SIZE<br>A | CODE IDENT<br>13499 | DWG NO.<br>649-2924-001 |
| SCALE     | REV                 | SHEET 127               |

APPENDIX A

AERODYNAMIC LOADING CALCULATIONS

|                  |                            |                                |
|------------------|----------------------------|--------------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br><b>649-2924-001</b> |
| SCALE            | REV                        | SHEET <b>A-1</b>               |

## A.0 - AERODYNAMIC CALCULATIONS

### A.1 - MAXIMUM DYNAMIC PRESSURE

REFERENCE: T.O. 1C-141A-1, FIGURE 5-8.

- MAX. PERMISSIBLE VELOCITY ABOVE 23,000-FT.  
ALTITUDE IS M=0.85
- MAX PERMISSIBLE VELOCITY BELOW 23,000-FT.  
ALTITUDE IS 380-KNOTS

#### A.1.1 - AT 23,000-FT ALTITUDE

$$C = 1025 - \text{FT/SEC}$$

$$\rho = .002378 \left( \frac{P}{P_0} \right) \left( \frac{T_0}{T} \right)$$

$$= (.002378)(.1046) \left( \frac{1}{.8419} \right) = .001143 \text{ LB-SEC}^2/\text{FT}^3$$

$$v = (1025)(.85) = 871 \text{ FT/SEC}$$

$$q_\infty = \frac{1}{2} \rho v^2$$

$$= \frac{1}{2} (.001143)(871)^2 = 434 - \text{LB/FT}^2$$

#### A.1.2 - AT SEA LEVEL

$$C = 1117 - \text{FT/SEC}$$

$$\rho = .002378 \text{ LB-SEC}^2/\text{FT}^3$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET A-2               |

$$n = (380)(1.689) \\ = 642 \text{ FT/SEC} \quad (M = .57)$$

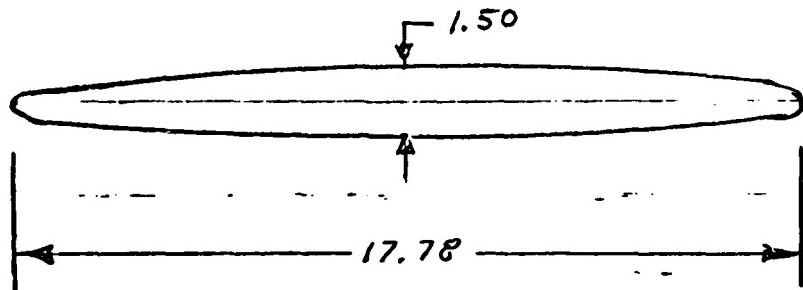
$$g_{\infty} = \frac{1}{2} (.002378)(642)^2 = 490 - 18/\text{FT}^2$$

## A.2-DRAG & LIFT FORCES

### ASSUMPTIONS:

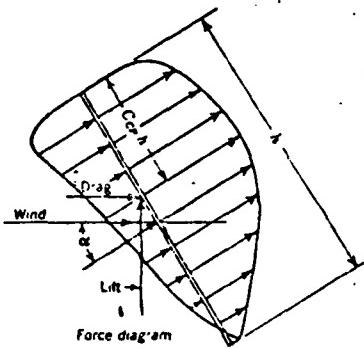
- AS A WORST-CASE, ASSUME THAT THE ANGLE-OF-ATTACK ON THE ANTENNA IS  $10^\circ$ .
- THE SAUCER PORTION OF THE ANTENNA WILL BE TREATED AS A FLAT DISC; RATHER THAN AS AN AIRFOIL.
- THE ENTIRE ANTENNA IS OUTSIDE THE BOUNDARY LAYER. (CONSERVATIVE)

### A.2.1 - SAUCER



$$\text{AREA} = \frac{\pi}{4} \left( \frac{17.78}{12} \right)^2 = 1.724 - \text{FT}^2$$

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET      A-3          |



(d) INCLINED PLATE

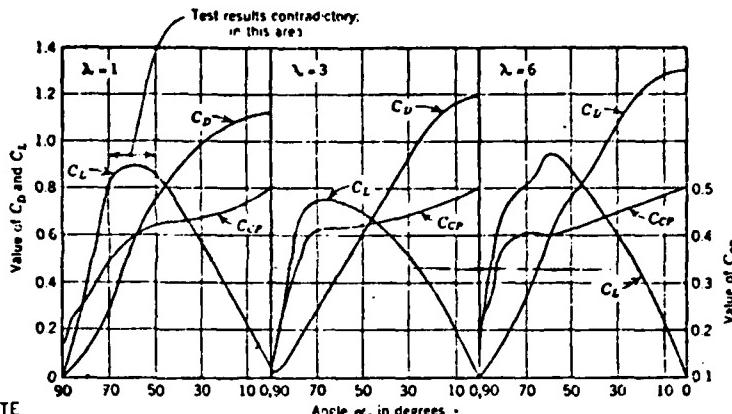


FIG. 5.—WIND PRESSURES ON ELEMENTARY BODIES

(FROM ASCE PAPER 3267)

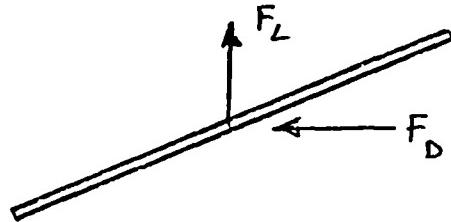
FOR  $\lambda = 1$  (A SQUARE PLATE) THE DRAG COEFFICIENT IS ALMOST THE SAME AS FOR A CIRCULAR PLATE OF THE SAME AREA.

FROM THE CURVES ABOVE (FOR  $\lambda = 1$ ), AT  $\alpha = 80^\circ$  :

$$C_D = .10$$

$$C_L = .40$$

$$C_{CP} = .26$$



(a) AT 23,000-FT ALTITUDE

$$F_D = C_D A \rho_\infty$$

$$= (.10)(1.724)(434) = 74.8 - \text{LB.}$$

$$F_L = C_L A \rho_\infty$$

$$= (.40)(1.724)(434) = 299.3 - \text{LB.}$$

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET        |
|       |            | A-4          |

$$\bar{x} = C_{cD} D = (.26)(17.78) = 1.62 - \text{IN. FROM TOP OF DISC}$$

(b) AT SEA LEVEL

$$F_D = (.10)(1.724)(490) = 84.5 - \text{LB.}$$

$$F_c = (.40)(1.724)(490) = 338.0 - \text{LB.}$$

A.2.2 - BAYONET

REFERENCE: DORNE & MARGOLIN ENGR. REPORT NO.  
7051.15, "DM C34-3 ANTENNA  
AERODYNAMIC ANALYSIS".

$$A_{REF} = 1.237 - \text{FT}^2.$$

(a) AT 23,000-FT ALTITUDE

$$C_D = .06683$$

$$F_D = (.06683)(1.237)(490) = 35.9 - \text{LB}$$

(b) AT SEA LEVEL

$$C_D \approx \frac{1}{2} (.00983 + .01133) = .01058$$

$$F_D = (.01058)(1.237)(490) = 6.7 - \text{LB.}$$

| SIZE  | CODE IDENT | DWG NO.      |
|-------|------------|--------------|
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET A-5    |

A.2.3 - TOTAL ANTENNA

REFERENCE: DORNE & MARCOLIN DRAWING  
261D1195, "DM C34-3/8 UHF  
ANTENNA".

$$Y_{SAUCER} \approx 10.48\text{-IN.}$$

$$Y_{BATONET} \approx 4.86\text{-IN.}$$

AT 23,000- FT ALTITUDE

$$F_D = 74.8 + 35.9 = 110.7\text{-LB}$$

$$F_L = 299.3\text{-LB}$$

$$\begin{aligned} M &= (74.8)(10.48) + (35.9)(4.86) + (299.3)(4.27) \\ &= 2,236\text{ IN-LB.} \end{aligned}$$

AT SEA LEVEL

$$F_D = 84.5 + 6.4 = 90.9\text{-LB.}$$

$$F_L = 338.0\text{-LB}$$

$$\begin{aligned} M &= (84.5)(10.48) + (6.4)(4.86) + (338.0)(4.27) \\ &= 2,350\text{ IN-LB.} \end{aligned}$$

|       |            |              |
|-------|------------|--------------|
| SIZE  | CODE IDENT | DWG NO.      |
| A     | 13499      | 649-2924-001 |
| SCALE | REV        | SHEET A-6    |

APPENDIX B

LISTING OF COMPUTER RESULTS

|                  |                            |                         |
|------------------|----------------------------|-------------------------|
| SIZE<br><b>A</b> | CODE IDENT<br><b>13499</b> | DWG NO.<br>649-2924-001 |
| SCALE            | REV                        | SHEET      B-1          |

74-8670-140

RESULTS OF LATENT ANALYSIS

RESULTS OF LATEST ANALYSIS

ACTIVE UNITS INCHES KIPS DEGREES  
ACTIVE STRUCTURE TYPE SPACE FRAME  
ACTIVE COORDINATE AXES X Y Z

LOADING • UKAG

| MENT  | CENTROID | SXX | *648678-03   | SYY | *.111959-02  | SKY | *.410852-01 |
|-------|----------|-----|--------------|-----|--------------|-----|-------------|
|       | VXX      | MXX | *.355519-02  | VYY | *.279333-02  | MXY | *.160105-05 |
| NUDE  | 101      |     | *.251569-02  | MYY | *.4247899-02 | MXY | *.342179-03 |
| TNUDE | 172      |     | *.502916-02  | MYY | *.520926-02  | MXY | *.171190-03 |
| NUUUE | 164      |     | *.157431-02  | MYY | *.792244-03  | MXY |             |
|       | SXX      | VXX | *100470-01   | SYY | *.137625-02  | SKY | *.278003-02 |
|       | MXX      | MXX | .298524-01   | VYY | *.450746-03  | MXY |             |
| NUDE  | 172      |     | *.109900-01  | MYY | *.110009-01  | MXY | *.107211-02 |
| NUDE  | 101      |     | *.112935-02  | MYY | *.117670-02  | MXY | *.331167-04 |
| NUUUE | 102      |     | *.6794240-02 | MYY | *.361193-02  | MXY | *.951104-03 |
|       | SXX      | VXX | *.658124-02  | SYY | *.561796-02  | SKY | *.992172-01 |
|       | MXX      | MXX | *.2094461-01 | VYY | *.140133-02  | MXY |             |
| NUDE  | 102      |     | *.816445-02  | MYY | *.786159-02  | MXY | *.107311-02 |
| NUUUE | 103      |     | *.663524-03  | MYY | *.683279-03  | MXY | *.263350-03 |
| NUUUE | 172      |     | *.795865-02  | MYY | *.556481-02  | MXY | *.678226-03 |

B-2

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NUDE 141 SXX -.2622143-02 MYY -.145344-02 MXY .116711-02

CENTROID SXX VXX -.333396-02 VYY .962546-02 SKY .150166-02

NUDE 104 VXX -.507564-03 VYY .112335-01 MYY -.226179-02 MXY .390123-03

NUDE 105 VXX -.199912-02 VYY -.515355-02 MXY .329359-03

NUDE 173 VXX .494676-02 MYY .575291-02 MXY .537299-03

NUDE 105 VXX .422356-02 MYY

NUDE 105 SXX -.207358-02 VYY .405322-02 SKY .205409-01

VXX .898439-02 VYY .777038-02 MYY .286862-02 MXY .115087-03

NUDE 106 VXX .302173-02 MYY .622729-02 MXY .329359-03

NUDE 173 VXX .618560-02 MYY .516126-02 MXY .107156-03

NUDE 105 VXX .391769-02 MYY

CENTROID SXX VXX -.235114-01 VYY -.216898-01 SKY .795759-02

NUDE 173 VXX -.142867-01 VYY .114722-02 MYY .786307-02 MXY .155356-03

NUDE 106 VXX .791766-02 MYY .197955-03

NUDE 142 VXX .232170-02 MYY .168531-02 MXY .212210-03

NUDE 107 SXX .140964-02 VYY .915153-02 SKY .113456-01

VXX .115734-01 VYY .469555-02 MYY .234410-02 MXY .28135-03

NUDE 174 SXX .364255-02 MYY .805237-02 MXY .922025-04

NUDE 143 SXX .950385-02 MYY .367641-02 MXY .19169-03

NUDE 107 SXX .937787-02 VYY .106086-01 SKY .150084-01

VXX .379003-03 VYY .530170-02 MYY .25974-02 MXY .641007-04

NUDE 106 SXX .137436-02 MYY .250396-02 MXY .641007-04

NUDE 174 SXX .114905-02 MYY .358913-02 MXY .603769-04

CENTROID SXX VXX .112607-01 VYY .242689-01 SKY .106843-01

NUDE 174 VXX .135156-01 VYY .789410-03 MYY .150176-03

NUDE 108 VXX .930523-02 MYY .79536-02 MXY .52775-03

NUDE 144 VXX .235515-02 MYY .994012-03 MXY .286868-03

NUDE 109 VXX .446895-02 MYY .216436-02 MXY .219531-03

CENTROID SXX VXX .168672-01 VYY .115410-01 SKY .961422-02

NUDE 109 VXX .165364-01 VYY .644632-02 MYY .341465-03

NUDE 110 VXX .445215-02 MYY .396172-02 MXY .117263-03

NUDE 175 VXX .261355-02 MYY .914066-02 MXY .52775-03

NUDE 175 VXX .107404-02 MYY .515767-02 MXY .434610-03

CENTROID SXX VXX .143574-01 VYY .934165-03 SKY .726370-02

NUDE 109 VXX .17541-04 VYY .605601-02 MYY .197021-02 MXY .491359-02

NUDE 110 VXX .143867-02 MYY .914066-02 MXY .641007-04

NUDE 175 VXX .63462-02 MYY .455244-02 MXY .219531-03

NUDE 175 VXX .11242-02 MYY .455244-02 MXY .533363-03



## UNIVAC 1100 SERIES ICES

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|     |          |            |                          |            |                          |     |            |
|-----|----------|------------|--------------------------|------------|--------------------------|-----|------------|
| 22  | CEN1010  | SXX<br>VXX | *104707-01<br>.162616-02 | STY<br>VYY | *467637-02<br>*501604-02 | STY | *429826-02 |
|     | NUDE 119 | MXX        | *17375-02                | MTY        | *02625-02                | MTY | *436209-03 |
|     | NUDE 119 | MXX        | *256461-02               | MTY        | *253707-02               | MTY | *436289-03 |
|     | NUDE 106 | MXX        | .373144-02               | MTY        | .371474-02               | MTY | *351043-03 |
| 165 | CEN1010  | SXX<br>VXX | *246665-02<br>.844529-02 | STY<br>VYY | *590285-02<br>*180086-01 | STY | *555076-02 |
|     | NUDE 166 | MXX        | *371656-02               | MTY        | *46405-02                | MTY | *167512-03 |
|     | NUDE 115 | MXX        | *184491-02               | MTY        | *54870-02                | MTY | *019756-03 |
|     | NUDE 176 | MXX        | *656327-02               | MTY        | *075512-02               | MTY | *493649-03 |
| 23  | CEN1010  | SXX<br>VXX | *318291-01<br>.638883-02 | STY<br>VYY | *541475-02<br>*938648-02 | STY | *219263-01 |
|     | NUDE 115 | MXX        | *479914-02               | MTY        | *510169-02               | MTY | *019786-03 |
|     | NUDE 116 | MXX        | .311515-02               | MTY        | .275307-02               | MTY | *215048-04 |
|     | NUDE 176 | MXX        | *599376-02               | MTY        | *871977-02               | MTY | *111178-02 |
| 24  | CEN1010  | SXX<br>VXX | *202608-01<br>.106226-01 | STY<br>VYY | *466680-01<br>*308518-01 | STY | *172566-01 |
|     | NUDE 116 | MAX        | *272839-02               | MTY        | *202323-02               | MTY | *244875-03 |
|     | NUDE 120 | MXX        | *915507-02               | MTY        | *948321-02               | MTY | *112732-02 |
|     | NUDE 176 | MXX        | *519202-02               | MTY        | *661161-02               | MTY | *227910-02 |
| 25  | CEN1010  | SXX<br>VXX | *219299-01<br>.252263-02 | STY<br>VYY | *581385-01<br>*163265-02 | STY | *234945-01 |
|     | NUDE 116 | MXX        | *142673-02               | MTY        | *132809-02               | MTY | *346414-03 |
|     | NUDE 151 | MXX        | *233264-02               | MTY        | *172416-02               | MTY | *208410-03 |
|     | NUDE 117 | MXX        | *583629-03               | MTY        | *744553-03               | MTY | *255310-03 |
| 26  | CEN1010  | SXX<br>VXX | *103718-01<br>.78536-04  | STY<br>VYY | *832647-02<br>*247116-05 | STY | *279352-02 |
|     | NUDE 119 | MXX        | *680703-05               | MTY        | *224213-03               | MTY | *994572-04 |
|     | NUDE 151 | MXX        | *282165-05               | MTY        | *153006-05               | MTY | *255311-03 |
|     | NUDE 116 | MXX        | *509495-05               | MTY        | *019557-04               | MTY | *177010-03 |
| 27  | CEN1010  | SXX<br>VXX | *126325-01<br>.176105-03 | STY<br>VYY | *765570-02<br>*276330-05 | STY | *333177-02 |
|     | NUDE 163 | MXX        | *335469-03               | MTY        | *176250-03               | MTY | *279011-03 |
|     | NUDE 119 | MXX        | *176046-03               | MTY        | *246226-03               | MTY | *129186-03 |
|     | NUDE 138 | MXX        | *545494-03               | MTY        | *771068-04               | MTY | *205091-03 |
| 28  | CEN1010  | SXX<br>VXX | *102295-01<br>.116038-02 | STY<br>VYY | *956138-01<br>*865269-03 | STY | *155345-01 |
|     | NUDE 163 | MXX        | *38076-02                | MTY        | *40365-02                | MTY | *020893-03 |
|     | NUDE 138 | MXX        | *60590-03                | MTY        | *67501-03                | MTY | *34442-03  |
|     | NUDE 137 | MXX        | *468109-03               | MTY        | *537241-03               | MTY | *156013-03 |

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|------|-------------|-------------------------|--------------|-----|--------------|-----|--------------|-----|-------------|-----|--------------|------|----|
|      |             | CENTROID                | SXX          | SYY | SXY          | STY | MYY          | MXX | MXY         | MYY | MXX          |      |    |
| 29   | NUDE 162    | VXX                     | *.220058-01  | VYY | *.421730-01  | SYY | *.398200-01  | MYY | *.108655-01 | MXX | *.126327-03  |      |    |
|      | NUDE 136    |                         | *.131622-01  |     |              |     | *.392659-02  | MYY |             |     | *.04593-03   |      |    |
|      | NUDE 185    |                         | *.109866-02  |     |              |     | *.492659-02  | MYY |             |     | *.109473-02  |      |    |
| 30   | CEN1010     | SXX                     | *.6666325-02 | SYY | *.312667-01  | SXY | *.173395-01  | MYY | *.179812-02 | MXX | *.213366-03  |      |    |
|      | NUDE 136    | VXX                     | .6666361-02  | VYY | .179812-02   | MYY | .386176-02   | MXX |             |     | *.38814-03   |      |    |
|      | NUDE 135    |                         | .161146      |     |              |     | .386176-02   | MXX |             |     | *.119420-03  |      |    |
|      | NUDE 185    |                         | *.477449-02  |     |              |     | *.984743-02  | MXX |             |     |              |      |    |
| 31   | CEN1010     | SXX                     | *.192266-01  | SYY | *.398758-02  | SXY | *.271303-02  | MYY | *.104123-03 | MXX | *.619522-02  |      |    |
|      | NUDE 136    | VXX                     | .209155-02   | VYY | .271303-02   | MYY | .269525-02   | MXX |             |     | *.47624-03   |      |    |
|      | NUDE 167    |                         | *.303195-03  |     |              |     | *.393137-04  | MXX |             |     | *.156452-03  |      |    |
|      | NUDE 135    |                         | *.507215-02  |     |              |     |              |     |             |     | *.138754-03  |      |    |
| 32   | CEN1010     | SXX                     | *.152799-01  | SYY | *.0553862-02 | SXY | *.192722-02  | MYY | *.478166-02 | MXX | *.119158-03  |      |    |
|      | NUDE 167    | VXX                     | .632165-02   | VYY | .192722-02   | MYY | .197144-03   | MXX |             |     | *.62564-04   |      |    |
|      | NUDE 134    |                         | *.520579-02  |     |              |     |              |     |             |     | *.911980-03  |      |    |
|      | NUDE 161    |                         | *.806244-02  |     |              |     |              |     |             |     |              |      |    |
| 33   | CEN1010     | SXX                     | *.1556890-02 | SYY | *.107649-01  | SXY | *.1710399-02 | MYY | *.152487-02 | MXX | *.953072-02  |      |    |
|      | NUDE 167    | VXX                     | *.199501-01  | VYY | .107649-01   | SYY | .100633-02   | MYY | .146259-02  | MXX | *.561461-03  |      |    |
|      | NUDE 165    |                         | *.274262-03  |     |              |     | *.220308-02  | MYY | .166631-02  | MXX | *.561101-03  |      |    |
|      | NUDE 135    |                         | *.806244-02  |     |              |     | *.22237-02   | MYY | *.207025-02 | MXX | *.322153-03  |      |    |
| 34   | CEN1010     | SXX                     | *.097571-02  | SYY | *.193703-01  | SXY | *.125395-02  | MYY | *.109026-02 | MXX | *.0339825-02 |      |    |
|      | NUDE 133    | VXX                     | *.1200885-01 | VYY | .193703-01   | SYY | .100633-02   | MYY | .146259-02  | MXX | *.333686-03  |      |    |
|      | NUDE 164    |                         | *.239739-02  |     |              |     | *.266631-02  | MYY | .166631-02  | MXX | *.339116-03  |      |    |
|      | NUDE 160    |                         | *.630983-02  |     |              |     | *.207025-02  | MYY |             |     |              |      |    |
| 35   | CEN1010     | SXX                     | *.354154-02  | SYY | *.774595-02  | SXY | *.306657-02  | MYY | *.109026-02 | MXX | *.213397-03  |      |    |
|      | NUDE 133    | VXX                     | *.179585-03  | VYY | .774595-02   | SYY | .109026-02   | MYY |             |     | *.213397-03  |      |    |
|      | NUDE 132    |                         | *.215007-03  |     |              |     |              |     |             |     | *.573156-04  |      |    |
|      | NUDE 184    |                         | *.008651-02  |     |              |     |              |     |             |     |              |      |    |
| 36   | CEN1010     | SXX                     | *.232049-01  | SYY | *.689478-02  | SXY | *.4936951-02 | MYY | *.588904-02 | MXX | *.0317603-02 |      |    |
|      | NUDE 184    | VXX                     | *.936951-02  | VYY | .689478-02   | MYY | .588904-02   | MXX |             |     | *.109150-03  |      |    |
|      | NUDE 132    |                         | *.320855-02  |     |              |     | *.193107-02  | MYY | *.115082-02 | MXX | *.165182-04  |      |    |
|      | NUDE 159    |                         | *.359606-02  |     |              |     | *.212483-02  | MYY |             |     | *.630195-04  |      |    |

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|    |   |            |  |                                 |  |                                 |  |
|----|---|------------|--|---------------------------------|--|---------------------------------|--|
| 53 | NUOC 101<br>NUOC 164                        | SXX<br>VXX | "-935551-02<br>"-157194-02<br>VYY  | STY<br>MYY<br>MYY               | "-249161-02<br>"-736750-03<br>SKY  | MYY<br>MYY<br>MYY               | "-160212-05<br>"-169211-03                               |
|    | NUOC 172<br>NUOC 165<br>NUOC 164            | SXX<br>VXX | "-201946-02<br>"-146276-02<br>"-954211-03<br>VYY                               | STY<br>MYY<br>MYY               | "-287506-02<br>"-950084-03<br>"-577987-03<br>SKY                               | MYY<br>MYY<br>MYY               | "-362379-05<br>"-246612-05<br>"-163916-03                |
| 54 | CENR010<br>NUOC 165<br>NUOC 172<br>NUOC 140 | SXX<br>VXX | "-133572-01<br>"-296666-01<br>"-136908-02<br>"-4308921-02<br>VYY               | STY<br>MYY<br>MYY<br>MYY        | "-451977-06<br>"-115120-01<br>"-221614-02<br>"-3639397-02<br>SKY               | MYY<br>MYY<br>MYY<br>MYY        | "-251916-02<br>"-3193n7-03<br>"-100611-02<br>"-130610-02 |
| 55 | CENR010<br>NUOC 141<br>NUOC 165<br>NUOC 140 | SXX<br>VXX | "-355075-01<br>"-366832-03<br>"-116636-02<br>"-411299-03<br>"-287542-02<br>VYY | STY<br>MYY<br>MYY<br>MYY<br>MYY | "-217506-01<br>"-207952-02<br>"-966662-04<br>"-351927-03<br>"-208796-02<br>SKY | MYY<br>MYY<br>MYY<br>MYY<br>MYY | "-802709-02<br>"-719146-03<br>"-605622-03<br>"-331126-03 |
| 56 | CENR010<br>NUOC 173<br>NUOC 165<br>NUOC 141 | SXX<br>VXX | "-111646-01<br>"-186829-01<br>"-613748-02<br>"-206611-02<br>"-535076-02<br>VYY | STY<br>MYY<br>MYY<br>MYY<br>MYY | "-536605-02<br>"-929416-02<br>"-859277-02<br>"-116237-02<br>"-235935-02<br>SKY | MYY<br>MYY<br>MYY<br>MYY<br>MYY | "-461737-02<br>"-361370-05<br>"-341370-05<br>"-705885-03 |
| 57 | CENR010<br>NUOC 142<br>NUOC 165<br>NUOC 173 | SXX<br>VAX | "-165926-01<br>"-415120-02<br>"-304431-03<br>"-642314-02<br>VYY                | STY<br>MYY<br>MYY<br>MYY        | "-791912-02<br>"-127139-01<br>"-443654-02<br>"-532103-03<br>"-343939-02<br>SKY | MYY<br>MYY<br>MYY<br>MYY        | "-186976-02<br>"-155336-03<br>"-34366-05<br>"-153612-04  |
| 58 | CENR010<br>NUOC 144<br>NUOC 165<br>NUOC 142 | SXX<br>VAX | "-277925-01<br>"-370444-02<br>"-456472-02<br>"-262601-02<br>"-561797-03<br>VYY | STY<br>MYY<br>MYY<br>MYY<br>MYY | "-116475-01<br>"-292643-03<br>"-395550-02<br>"-148688-02<br>"-102230-04<br>SKY | MYY<br>MYY<br>MYY<br>MYY<br>MYY | "-296576-03<br>"-144446-04<br>"-562207-03<br>"-220302-03 |
| 59 | CENR010<br>NUOC 165<br>NUOC 143<br>NUOC 166 | SXX<br>VAX | "-126376-01<br>"-356812-02<br>"-534227-03<br>"-406643-03<br>"-532995-03<br>VYY | STY<br>MYY<br>MYY<br>MYY<br>MYY | "-479832-02<br>"-106716-06<br>"-505593-04<br>"-103503-03<br>"-472343-03<br>SKY | MYY<br>MYY<br>MYY<br>MYY<br>MYY | "-401400-02<br>"-196396-04<br>"-56505-03<br>"-993360-04  |
| 60 | CENR010<br>NUOC 166<br>NUOC 143             | SAX<br>VAX | "-120056-02<br>"-15681-01<br>"-432676-03<br>"-672355-02<br>VYY                 | STY<br>MYY<br>MYY<br>MYY        | "-724546-03<br>"-756277-02<br>"-229485-03<br>"-703445-02<br>SKY                | MYY<br>MYY<br>MYY<br>MYY        | "-333765-02<br>"-516747-04<br>"-22074-04                 |

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NODE 174

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MYY

.356200-02

MXY

.201627-04

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STY

.356926-02

SKY

.2246110-02

VXX

.175416-01

VYY

.104400-01

MYY

.667490-02

MXY

.150176-03

MAX

.604646-02

MYY

.10536-03

MXY

.518167-04

MXX

.795262-03

MYY

.350086-02

MXY

MXX

.781404-02

MYY

.101027-03

MXX

.373603-03

MYY

.391056-03

MXY

MXX

.9966386-03

SYY

.013249-04

SKY

.158137-02

MAX

.122504-03

MYY

.111323-03

MXY

MAX

.269426-04

MYY

.590012-03

MXY

MAX

.373603-03

MYY

.292219-04

MAX

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MYY

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MAX

.316957-02

MYY

.733661-03

MAX

.219770-02

SKY

.106741-02

MAX

.162607-02

MYY

.961675-03

MAX

.116074-04

MYY

.330297-04

MAX

.316957-02

MYY

.733661-03

MAX

.352661-02

SKY

.174295-02

MAX

.117762-02

MYY

.522753-03

MAX

.775102-02

MYY

.456947-03

MAX

.493568-02

MYY

.456666-02

SKY

.174295-02

MAX

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MYY

.537549-02

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.133391-02

MYY

.891843-14

MAX

.322048-03

MYY

.131657-03

MAX

.327896-04

MAX

.661024-03

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SKY

CENTROID

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MAX

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.775102-02

MXY

MAX

.1344342-02

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SKY

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STY

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VYY

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MAX

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MYY

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MXY

MAX

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.122752-02

MXY

MAX

.577253-02

MYY

.322048-02

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MAX

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SKY

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STY

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SKY

CENTROID

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MXY

MAX

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MYY

.322048-03

MXY

MAX

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STY

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SKY

CENTROID

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MAX

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MYY

.661024-03

MXY

MAX

.255793-01

STY

.2687059-02

SKY

CENTROID

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VYY

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MAX

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MYY

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MXY

MAX

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MYY

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.106329-03

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.265920-04

MYY

.272800-03

MAX

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|     |          |     |              |     |             |     |             |
|-----|----------|-----|--------------|-----|-------------|-----|-------------|
| 69  | CENIR010 | SIX | .196070-01   | SIV | .165216-02  | SIV | -.731330-02 |
|     | NUDE 146 | VIX | -.214995-01  | VIV | .195034-01  |     |             |
|     | NUDE 166 | MIX | -.556250-02  | MIV | -.53497-02  | MIV | -.52816-03  |
|     | NUDE 168 | MIX | -.101876-03  | MIV | -.261061-03 | MIV | -.43071-03  |
|     | NUDE 176 | MIX | .617370-02   | MIV | .300703-02  | MIV | -.48044-03  |
| 70  | CENIR010 | SIX | -.137239-02  | SIV | .288101-03  | SIV | -.635117-03 |
|     | NUDE 147 | VIX | .236687-04   | VIV | -.669356-03 |     |             |
|     | NUDE 166 | MIX | -.135139-02  | MIV | -.655900-03 | MIV | -.290039-03 |
|     | NUDE 168 | MIX | -.227114-02  | MIV | -.946812-03 | MIV | -.82416-03  |
|     | NUDE 176 | MIX | -.296166-02  | MIV | -.135415-02 | MIV | -.646160-03 |
| 71  | CENIR010 | SIX | .136925-01   | SIV | .300961-02  | SIV | .149952-02  |
|     | NUDE 147 | VIX | .166567-03   | VIV | .117016-03  |     |             |
|     | NUDE 166 | MIX | .170442-03   | MIV | .255958-03  | MIV | .57750-03   |
|     | NUDE 168 | MIX | -.214943-03  | MIV | .103624-03  | MIV | .612911-04  |
|     | NUDE 176 | MIX | -.515212-03  | MIV | .103168-02  | MIV | .567167-04  |
| 72  | CENIR010 | SIX | .269937-01   | SIV | .622039-02  | SIV | .169822-02  |
|     | NUDE 147 | VIX | .111062-01   | VIV | .637202-02  |     |             |
|     | NUDE 166 | MIX | .833563-03   | MIV | .701955-03  | MIV | .10142-03   |
|     | NUDE 168 | MIX | -.4963541-02 | MIV | .480057-02  | MIV | .122646-03  |
|     | NUDE 176 | MIX | .531649-02   | MIV | .240560-02  | MIV | .116394-03  |
| 73  | CENIR010 | SIX | .164411-01   | SIV | .210004-02  | SIV | .572305-02  |
|     | NUDE 147 | VIX | -.139869-01  | VIV | .944573-02  |     |             |
|     | NUDE 166 | MIX | .398987-02   | MIV | .367503-02  | MIV | .279420-03  |
|     | NUDE 168 | MIX | -.19569-02   | MIV | .770556-03  | MIV | .101442-03  |
|     | NUDE 176 | MIX | -.562233-02  | MIV | .290010-02  | MIV | .192021-03  |
| 74  | CENIR010 | SIX | .122265-01   | SIV | .495634-02  | SIV | -.705562-03 |
|     | NUDE 147 | VIX | -.310168-03  | VIV | .6679515-04 |     |             |
|     | NUDE 166 | MIX | .503012-03   | MIV | .74532-03   | MIV | .26419-03   |
|     | NUDE 168 | MIX | -.350174-03  | MIV | .13474-02   | MIV | .17588-04   |
|     | NUDE 176 | MIX | .9724195-03  | MIV | .120539-02  | MIV | .107792-03  |
| 75  | CENIR010 | SIX | .522932-03   | SIV | .181505-02  | SIV | .516208-04  |
|     | NUDE 147 | VIX | -.972445-03  | VIV | .444357-03  |     |             |
|     | NUDE 166 | MIX | -.130157-02  | MIV | .11737-03   | MIV | .263571-03  |
|     | NUDE 168 | MIX | -.120846-02  | MIV | .903574-03  | MIV | .203661-03  |
|     | NUDE 176 | MIX | -.180411-02  | MIV | .460015-03  | MIV | .286551-04  |
| 167 | CENIR010 | SIX | .168117-01   | SIV | .764146-02  | SIV | .136701-02  |
|     | NUDE 147 | VIX | .113653-01   | VIV | .746052-02  |     |             |
|     | NUDE 166 | MIX | .563557-02   | MIV | .633333-02  | MIV | .153611-03  |
|     | NUDE 170 | MIX | .618025-03   | MIV | .753510-03  | MIV | .263571-03  |
|     | NUDE 176 | MIX | -.241232-02  | MIV | .910478-03  | MIV | .203361-03  |



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|-------------|----------|-----|--------------|-----|--------------|-----|--------------|
| 64          | CENTROID | SIX | *.9366079-02 | SIX | *.186946-01  | SIX | *.5864543-02 |
|             | NUDE 170 | VAX | *.768169-02  | VIT | *.152172-01  |     |              |
|             | NUDE 162 | MXX | *.745471-03  | MYY | *.216449-02  | MXY | *.215702-03  |
|             | NUDE 185 | MXX | *.891064-02  | MYY | *.107082-01  | MXY | *.282293-03  |
|             |          | MXX | *.594461-02  | MYY | *.512034-02  | MXY | *.270714-02  |
| 65          | CENTROID | SIX | *.136375-02  | SIX | *.190639-02  | SIX | *.664675-02  |
|             | NUDE 170 | VAX | *.582264-02  | VIT | *.104184-02  |     |              |
|             | NUDE 169 | MXX | *.17849-02   | MYY | *.39267-03   | MXY | *.334426-03  |
|             | NUDE 187 | MXX | *.794663-02  | MYY | *.656466-02  | MXY | *.561161-03  |
|             |          | MXX | *.441305-02  | MYY | *.347066-02  | MXY | *.915027-04  |
| 66          | CENTROID | SIX | *.205872-01  | SIX | *.754377-02  | SIX | *.783382-03  |
|             | NUDE 170 | VAX | *.971197-02  | VIT | *.647912-02  |     |              |
|             | NUDE 167 | MXX | *.143203-02  | MYY | *.117986-02  | MXY | *.139405-03  |
|             | NUDE 161 | MXX | *.375530-02  | MYY | *.644465-02  | MXY | *.19438-03   |
|             |          | MXX | *.143330-02  | MYY | *.882290-03  | MXY | *.100834-04  |
| 67          | CENTROID | SIX | *.126266-02  | SIX | *.116007-02  | SIX | *.107970-02  |
|             | NUDE 160 | VAX | *.121212-02  | VIT | *.59521-03   |     |              |
|             | NUDE 170 | MXX | *.189107-02  | MYY | *.145444-02  | MXY | *.170211-03  |
|             | NUDE 161 | MXX | *.3M2959-03  | MYY | *.547337-03  | MXY | *.139105-03  |
|             |          | MXX | *.362204-03  | MYY | *.509399-04  | MXY | *.15434-04   |
| 68          | CENTROID | SIX | *.123570-01  | SIX | *.450636-02  | SIX | *.216653-02  |
|             | NUDE 170 | VAX | *.320662-03  | VIT | *.7893971-09 |     |              |
|             | NUDE 160 | MXX | *.379176-03  | MYY | *.920365-02  | MXY | *.175886-04  |
|             | NUDE 169 | MXX | *.433550-03  | MYY | *.662445-03  | MXY | *.262315-03  |
|             |          | MXX | *.9M2106-03  | MYY | *.126398-02  | MXY | *.94221-04   |
| 69          | CENTROID | SIX | *.159852-01  | SIX | *.187070-02  | SIX | *.682630-02  |
|             | NUDE 169 | VAX | *.157789-01  | VIT | *.920365-02  |     |              |
|             | NUDE 160 | MXX | *.110421-02  | MYY | *.820124-03  | MXY | *.104209-03  |
|             | NUDE 184 | MXX | *.383535-02  | MYY | *.347026-02  | MXY | *.309018-03  |
|             |          | MXX | *.555127-02  | MYY | *.287771-02  | MXY | *.206613-03  |
| 70          | CENTROID | SIX | *.273339-01  | SIX | *.561537-02  | SIX | *.122933-02  |
|             | NUDE 159 | VAX | *.16333-01   | VIT | *.625111-02  |     |              |
|             | NUDE 169 | MXX | *.464526-02  | MYY | *.481150-02  | MXY | *.109630-03  |
|             | NUDE 184 | MXX | *.907762-03  | MYY | *.75524-03   | MXY | *.104209-03  |
|             |          | MXX | *.522898-02  | MYY | *.227665-02  | MXY | *.106520-03  |
| 71          | CENTROID | SIX | *.139324-01  | SIX | *.373607-02  | SIX | *.295670-04  |
|             | NUDE 159 | VAX | *.178966-03  | VIT | *.137840-03  |     |              |
|             | NUDE 160 | MXX | *.292117-03  | MYY | *.108893-04  | MXY | *.615969-04  |
|             | NUDE 169 | MXX | *.146619-03  | MYY | *.486552-03  | MXY | *.57450-05   |
|             |          | MXX | *.315336-03  | MYY | *.105705-02  | MXY | *.704176-04  |

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|          |     |            |     |            |
|----------|-----|------------|-----|------------|
| NUDE 160 | VXX | .183103-02 | VYY | .549661-03 |
| NUDE 159 | MXX | .211475-02 | MTY | .782060-03 |
| NUDE 158 | MXX | .152790-02 | MTY | .260600-03 |
|          | MXX | .268066-02 | MTY | .393103-03 |

|          |     |            |     |            |
|----------|-----|------------|-----|------------|
| CENTROID | SXX | .136269-01 | STY | .113719-02 |
| NUDE 160 | VXX | .191955-01 | VYY | .177955-01 |
| NUDE 159 | MXX | .131424-04 | MTY | .576562-03 |
| NUDE 163 | MXX | .513526-02 | MTY | .55950-02  |
|          | MXX | .548017-02 | MTY | .251768-02 |

|          |     |            |     |            |
|----------|-----|------------|-----|------------|
| CENTROID | SXX | .170765-01 | STY | .228209-02 |
| NUDE 159 | VXX | .396039-02 | VYY | .567366-04 |
| NUDE 168 | MXX | .409655-02 | MTY | .361567-02 |
| NUDE 163 | MXX | .731766-03 | MTY | .613701-03 |
|          | MXX | .420690-02 | MTY | .243114-02 |

|          |     |            |     |            |
|----------|-----|------------|-----|------------|
| CENTROID | SXX | .453793-02 | STY | .283573-02 |
| NUDE 159 | VXX | .663422-03 | VYY | .576149-03 |
| NUDE 160 | MXX | .180770-02 | MTY | .147359-02 |
| NUDE 159 | MXX | .74717-03  | MTY | .911753-03 |
|          | MXX | .105167-02 | MTY | .559381-03 |

|          |     |             |     |            |
|----------|-----|-------------|-----|------------|
| CENTROID | SXX | .4658669-02 | STY | .225125-02 |
| NUDE 159 | VXX | .056555-02  | VYY | .163206-03 |
| NUDE 167 | MXX | .616160-05  | MTY | .609747-03 |
| NUDE 121 | MXX | .127135-02  | MTY | .649561-02 |
|          | MXX | .104110-02  | MTY | .556342-03 |

|          |     |            |     |            |
|----------|-----|------------|-----|------------|
| CENTROID | SXX | .576206-02 | STY | .356326-02 |
| NUDE 167 | VXX | .701053-02 | VYY | .520324-03 |
| NUDE 159 | MXX | .19246-03  | MTY | .035327-02 |
| NUDE 162 | MXX | .689463-02 | MTY | .661115-02 |
|          | MXX | .699036-02 | MTY | .355709-02 |

|          |     |            |     |            |
|----------|-----|------------|-----|------------|
| CENTROID | SXX | .253371-01 | STY | .100430-01 |
| NUDE 157 | VXX | .233446-01 | VYY | .140071-01 |
| NUDE 167 | MXX | .533966-02 | MTY | .85327-02  |
| NUDE 162 | MXX | .626235-03 | MTY | .987670-03 |
|          | MXX | .862630-02 | MTY | .403638-02 |

|          |     |             |     |             |
|----------|-----|-------------|-----|-------------|
| CENTROID | SXX | .2225476-01 | STY | .120650-02  |
| NUDE 156 | VXX | .699966-02  | VYY | .957649-03  |
| NUDE 167 | MXX | .627507-03  | MTY | .191183-04  |
| NUDE 157 | MXX | .99639-02   | MTY | .662449-02  |
|          | MXX | .589741-02  | MTY | .3536921-02 |

|          |     |             |     |            |
|----------|-----|-------------|-----|------------|
| CENTROID | SXX | .0661934-02 | STY | .167110-02 |
| NUDE 159 | VXX | .149135-03  | VYY | .134145-03 |

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| UNIVAC 1100 SERIES ICES |          |     |             |     |            |     |             |  |  |
|-------------------------|----------|-----|-------------|-----|------------|-----|-------------|--|--|
|                         |          |     |             |     |            |     |             |  |  |
| 100                     | NUDE 167 | MAX | -4649937-04 | MTY | -657258-03 | MTY | -6292219-04 |  |  |
|                         | NUDE 156 | MAX | -612229-03  | MTY | -116541-03 | MTY | -463358-03  |  |  |
|                         | NUDE 166 | MAX | +298948-03  | MTY | +239680-03 | MTY | +1508943-03 |  |  |
| 101                     | CENIROID | SXX | -6229582-02 | SYY | -525100-02 | SXY | .312111-02  |  |  |
|                         | NUDE 166 | MAX | -1394061-01 | VYY | -121634-01 | MTY | -342309-03  |  |  |
|                         | NUDE 156 | MAX | -168142-02  | MTY | -164721-02 | MTY | -222165-03  |  |  |
|                         | NUDE 181 | MAX | -896800-02  | MTY | -102625-01 | MTY | -590618-04  |  |  |
| 102                     | CENIROID | SXX | -009900-03  | SYY | -563803-03 | SXY | -169329-02  |  |  |
|                         | NUDE 155 | MAX | -4649406-03 | MTY | -934480-03 | MTY | -327849-04  |  |  |
|                         | NUDE 166 | MAX | +80278-03   | MTY | -164920-03 | MTY | -14364-03   |  |  |
|                         | NUDE 156 | MAX | +274470-02  | MTY | +104922-02 | MTY | -546515-04  |  |  |
| 103                     | CENIROID | SXX | -1266036-01 | SYY | -493786-02 | SXY | -496445-02  |  |  |
|                         | NUDE 155 | MAX | 355779-04   | VYY | -278374-04 | MTY | -267506-03  |  |  |
|                         | NUDE 165 | MAX | -469320-03  | MTY | -264040-03 | MTY | -166998-04  |  |  |
|                         | NUDE 166 | MAX | -628596-03  | MTY | -450050-03 | MTY | -453699-04  |  |  |
| 104                     | CENIROID | SXX | -278993-01  | SYY | -113547-01 | SXY | -469866-03  |  |  |
|                         | NUDE 165 | MAX | -223298-02  | VYY | -126554-04 | MTY | -126469-04  |  |  |
|                         | NUDE 155 | MAX | -239545-02  | MTY | -153777-02 | MTY | -153625-04  |  |  |
|                         | NUDE 154 | MAX | -31817-02   | MTY | -303949-02 | MTY | -197868-03  |  |  |
| 105                     | CENIROID | SXX | -191376-01  | SYY | -784764-02 | SXY | -210033-02  |  |  |
|                         | NUDE 165 | MAX | -163067-01  | VYY | -127231-01 | MTY | -124468-04  |  |  |
|                         | NUDE 154 | MAX | -263155-03  | MTY | -595959-03 | MTY | -113440-03  |  |  |
|                         | NUDE 160 | MAX | -449023-02  | MTY | -453357-02 | MTY | -515766-04  |  |  |
|                         | NUDE 154 | MAX | -640610-02  | MTY | -340705-02 | MTY | -720142-03  |  |  |
| 106                     | CENIROID | SXX | -110209-01  | SYY | -516915-02 | SXY | -453243-02  |  |  |
|                         | NUDE 165 | MAX | 118296-01   | VYY | 930105-02  | MTY | -709762-01  |  |  |
|                         | NUDE 160 | MAX | -207277-02  | MTY | -107772-02 | MTY | -122468-04  |  |  |
|                         | NUDE 155 | MAX | -113146-02  | MTY | -8512-02   | MTY | -124468-04  |  |  |
| 107                     | CENIROID | SXX | -330868-01  | SYY | -213001-01 | SXY | -709762-01  |  |  |
|                         | NUDE 165 | MAX | 314808-03   | VYY | -207754-02 | MTY | -6047-03    |  |  |
|                         | NUDE 155 | MAX | -44018-03   | MTY | -891977-03 | MTY | -73374-03   |  |  |
|                         | NUDE 152 | MAX | -119937-02  | MTY | -203081-02 | MTY | -34153-03   |  |  |
|                         | NUDE 174 | MAX | -294440-02  | MTY | -          |     | -           |  |  |

| UNIVAC 1100 SERIES ICES |          |     |   |            |     |   |            |     |     | DATE 082280 |            | PAGE - 43 |  |
|-------------------------|----------|-----|---|------------|-----|---|------------|-----|-----|-------------|------------|-----------|--|
| NUUC 163                |          | MAX | - | .195391-02 | MYY | - | .210087-02 |     | MXY | -           | .319795-03 |           |  |
| NUOC 152                |          | MAX | - | .430363-02 | MYY | - | .369813-02 |     | MXY | -           | .210906-02 |           |  |
|                         |          |     |   |            |     |   |            |     |     |             |            |           |  |
| 108                     | CENTROID | SXX | - | .554221-02 | STY | - | .435476-02 | SKY | -   | .450712-02  |            |           |  |
|                         |          | VXX | - | .157052-02 | VYY | - | .284787-02 |     | MXY | -           | .210678-05 |           |  |
|                         |          | MAX | - | .148611-02 | MYY | - | .204522-03 |     | MXY | -           | .310175-03 |           |  |
|                         |          | MAX | - | .203039-02 | MYY | - | .284453-02 |     | MXY | -           | .112931-03 |           |  |
|                         |          | MAX | - | .962022-03 | MYY | - | .573402-03 |     | MXY | -           |            |           |  |
|                         |          |     |   |            |     |   |            |     |     |             |            |           |  |
| 109                     | CENTROID | SXX | - | .113363-02 | STY | - | .331917-02 | SKY | -   | .158606-02  |            |           |  |
|                         |          | VXX | - | .255035-02 | VYY | - | .677070-04 |     | MXY | -           | .819230-05 |           |  |
|                         |          | MAX | - | .656867-03 | MYY | - | .224895-03 |     | MXY | -           |            |           |  |
|                         |          | MAX | - | .752230-03 | MYY | - | .134761-02 |     | MXY | -           | .16506-03  |           |  |
|                         |          | MAX | - | .502235-03 | MYT | - | .207775-02 |     | MXY | -           | .774791-04 |           |  |
|                         |          |     |   |            |     |   |            |     |     |             |            |           |  |
| 110                     | CENTROID | SAX | - | .697931-02 | STY | - | .510461-02 | SKY | -   | .190214-02  |            |           |  |
|                         |          | VXX | - | .746606-03 | VYY | - | .182102-03 |     | MXY | -           | .475418-03 |           |  |
|                         |          | MAX | - | .413585-04 | MYY | - | .405067-02 |     | MXY | -           | .422328-04 |           |  |
|                         |          | MAX | - | .294477-02 | MYV | - | .375053-02 |     | MXY | -           | .245020-03 |           |  |
|                         |          | MAX | - | .164010-02 | MYT | - | .104613-02 |     | MXY | -           |            |           |  |
|                         |          |     |   |            |     |   |            |     |     |             |            |           |  |
| 111                     | CENTROID | SXX | - | .778176-02 | STY | - | .536942-02 | SKY | -   | .6337275-02 |            |           |  |
|                         |          | VXX | - | .470065-02 | VYY | - | .166530-02 |     | MXY | -           |            |           |  |
|                         |          | MAX | - | .179055-02 | MYV | - | .56853-03  |     | MXY | -           |            |           |  |
|                         |          | MAX | - | .150125-02 | MYY | - | .164405-02 |     | MXY | -           | .47418-03  |           |  |
|                         |          | MAX | - | .356672-02 | MYT | - | .165284-02 |     | MXY | -           | .614274-03 |           |  |
|                         |          |     |   |            |     |   |            |     |     |             |            |           |  |
| 112                     | CENTROID | SXX | - | .606630-02 | STY | - | .186438-01 | SKY | -   | .266605-01  |            |           |  |
|                         |          | VXX | - | .553350-04 | VYY | - | .768434-04 |     | MXY | -           |            |           |  |
|                         |          | MAX | - | .122009-03 | MYV | - | .765901-03 |     | MXY | -           | .697187-03 |           |  |
|                         |          | MAX | - | .380391-03 | MYY | - | .253561-03 |     | MXY | -           | .690842-03 |           |  |
|                         |          | MAX | - | .152312-03 | MYT | - | .104003-02 |     | MXY | -           | .69014-03  |           |  |
|                         |          |     |   |            |     |   |            |     |     |             |            |           |  |
| 113                     | CENTROID | SXX | - | .103514-01 | STY | - | .167618-01 | SKY | -   | .163196-01  |            |           |  |
|                         |          | VXX | - | .180620-03 | VYY | - | .724604-04 |     | MXY | -           |            |           |  |
|                         |          | MAX | - | .504111-03 | MYV | - | .68904-03  |     | MXY | -           | .538790-03 |           |  |
|                         |          | MAX | - | .328616-03 | MYY | - | .191569-02 |     | MXY | -           | .736596-03 |           |  |
|                         |          | MAX | - | .143492-03 | MYT | - | .122332-02 |     | MXY | -           | .631693-03 |           |  |
|                         |          |     |   |            |     |   |            |     |     |             |            |           |  |
| 114                     | CENTROID | SXX | - | .166327-01 | STY | - | .281176-02 | SKY | -   | .715319-02  |            |           |  |
|                         |          | VXX | - | .169404-02 | VYY | - | .101066-02 |     | MXY | -           |            |           |  |
|                         |          | MAX | - | .210496-02 | MYV | - | .450847-02 |     | MXY | -           |            |           |  |
|                         |          | MAX | - | .461666-03 | MYY | - | .591653-03 |     | MXY | -           | .61046-03  |           |  |
|                         |          | MAX | - | .143492-02 | MYT | - | .122332-02 |     | MXY | -           | .561866-03 |           |  |
|                         |          |     |   |            |     |   |            |     |     |             |            |           |  |
| 115                     | CENTROID | SXX | - | .219982-01 | STY | - | .104116-02 | SKY | -   | .190401-01  |            |           |  |
|                         |          | VXX | - | .341651-02 | VYY | - | .450847-02 |     | MXY | -           |            |           |  |
|                         |          | MAX | - | .100100-02 | MYV | - | .290552-02 |     | MXY | -           |            |           |  |
|                         |          | MAX | - | .179625-02 | MYY | - | .591653-03 |     | MXY | -           | .601662-03 |           |  |
|                         |          | MAX | - | .143492-02 | MYT | - | .122332-02 |     | MXY | -           | .561866-03 |           |  |



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124 CENIROID SXX .637959-01 STY .261551-01 SKY .960201-02  
 VXX .736092-03 VTY .602337-04 MXY .357365-03  
 MXM .542951-04 MYY .418177-04 MXY .357365-03  
 MXM .714944-03 MYY .706324-03 MXY .254444-03  
 MXM .55210-03 MYY .176668-03 MXY .262857-03

125 CENIROID SXX .111170-01 STY .683485-02 SKY .333503-01  
 VXX .592696-03 VTY .160759-02 MXY .625279-04  
 MXM .250288-03 MYY .365984-03 MXY .435289-04  
 MXM .424537-03 MYY .357576-03 MXY .435289-04  
 MXM .124432-02 MYY .127294-02 MXY .259452-03

126 CENIROID SXX .291632-01 STY .155207-01 SKY .196227-01  
 VXX .195343-02 VTY .446026-02 MXY .055568-05  
 MXM .256839-02 MYY .312204-02 MXY .733568-04  
 MXM .675049-03 MYY .416221-04 MXY .137210-03  
 MXM .157577-03 MYY .2534628-03 MXY .137210-03

127 CENIROID SXX .226039-01 STY .133496-01 SKY .511396-01  
 VXX .38565-02 VTY .161969-02 MXY .402030-03  
 MXM .216640-02 MYY .121560-02 MXY .653663-05  
 MXM .688431-03 MYY .170636-02 MXY .941846-04  
 MXM .136666-02 MYY .298700-03 MXY .137210-03

128 CENIROID SXX .257758-02 STY .132042-00 SKY .877631-11  
 VXX .468011-03 VTY .279248-02 MXY .171665-03  
 MXM .331119-03 MYY .657059-03 MXY .571923-04  
 MXM .167495-02 MYY .663744-03 MXY .110638-03  
 MXM .369119-03 MYY .211695-02 MXY .1767802-02

129 CENIROID SXX .228593-03 STY .757016-02 SKY .613702-02  
 VXX .637306-05 VTY .272715-02 MXY .801028-02  
 MXM .340407-02 MYY .152336-02 MXY .734577-02  
 MXM .536238-02 MYY .253016-02 MXY .1767802-02  
 MXM .141123-02 MYY .053705-03 MXY .669536-03

130 CENIROID SXX .200468-01 STY .603055-02 SKY .936830-02  
 VXX .27945-02 VTY .348610-02 MXY .539265-02  
 MXM .710665-03 MYY .96226-03 MXY .71796-02  
 MXM .53374-04 MYY .251576-02 MXY .641679-02  
 MXM .479510-02 MYY .669536-03 MXY .467632-02

131 CENIROID SXX .282995-01 STY .530715-02 SKY .150391-01  
 VXX .106697-02 VTY .240427-02 MXY .593525-02  
 MXM .441123-02 MYY .110063-02 MXY .539265-02  
 MXM .793910-03 MYY .174132-02 MXY .71796-02  
 MXM .5h7034-02 MYY .79203-03 MXY .641679-02

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132 CENTROID SMM \*476458-02 STY \*+530492-02 SKY \*150913-01

NUDE 116 VMM \*1122911-02 VTY \*392634-02 MYY \*375415-02

NUDE 119 VMM \*731047-02 MYY \*137502-02 MYY \*14362-02

NUDE 119 VMM \*108701-01 MYY \*22083-03 MYY \*260399-02

NUDE 119 VMM \*325908-02 MYY \*108352-03 MYY \*260399-02

133 CENTROID SMM \*368065-03 STY \*337380-02 SKY \*969978-03

NUDE 1 VMM \*237463-03 VTY \*681168-04 MYY \*89262-03

NUDE 122 MAX \*659756-03 MYY \*22456-03 MYY \*125862-03

NUDE 101 MAX \*765575-03 MYY \*136569-02 MYY \*586947-03

NUDE 101 MAX \*505270-03 MYY \*208624-02 MYY \*586947-03

134 CENTROID SMM \*675112-02 STY \*520075-02 SKY \*138467-02

NUDE 122 VMM \*681724-03 VTY \*220522-03 MYY \*451007-03

NUDE 1 MAX \*411919-02 MYY \*408949-02 MYY \*233986-04

NUDE 22 MAX \*291861-02 MYY \*376947-02 MYY \*220846-03

NUDE 22 MAX \*136297-02 MYY \*100771-02 MYY \*100771-02

135 CENTROID SMM \*746716-02 STY \*538465-02 SKY \*586420-02

NUDE 23 VMM \*682433-02 VTY \*137726-02 MYY \*915850-03

NUDE 122 MAX \*178416-02 MYY \*560700-03 MYY \*451007-03

NUDE 22 MAX \*146701-02 MYY \*162819-02 MYY \*451007-03

NUDE 22 MAX \*326977-02 MYY \*162595-02 MYY \*586421-03

136 CENTROID SAM \*363314-02 STY \*162603-01 SKY \*239966-01

NUDE 122 VMM \*500956-04 VTY \*754065-04 MYY \*660089-03

NUDE 23 MAX \*130165-03 MYY \*769602-03 MYY \*658932-03

NUDE 123 MAX \*372063-03 MYY \*26117-03 MYY \*663660-03

NUDE 123 MAX \*151595-03 MYY \*104211-02 MYY \*593495-03

137 CENTROID SMM \*9090911-02 STY \*164440-01 SKY \*160057-01

NUDE 24 VMM \*175664-03 VTY \*769517-04 MYY \*987492-03

NUDE 125 MAX \*225145-03 MYY \*705011-03 MYY \*329121-03

NUDE 24 MAX \*341527-03 MYY \*194512-02 MYY \*569165-03

NUDE 25 MAX \*364972-03 MYY \*20536-02 MYY \*512199-03

138 CENTROID SMM \*162208-01 STY \*226664-02 SKY \*610606-02

NUDE 125 VMM \*166776-02 VTY \*101029-02 MYY \*472631-02 MYY \*329121-03

NUDE 24 MAX \*216773-02 MYY \*310286-02 MYY \*613610-03 MYY \*42678-04

NUDE 25 MAX \*442253-03 MYY \*97052-03 MYY \*666850-03 MYY \*42678-04

NUDE 25 MAX \*140931-02 MYY \*121914-02 MYY \*310517-03 MYY \*42678-04

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|     |          |     |            |     |            |     |             |
|-----|----------|-----|------------|-----|------------|-----|-------------|
| 140 | CENTROID | SXX | -163401-01 | STY | -365264-01 | SXY | -227304-01  |
|     | VXX      | MXX | .264342-03 | VYY | .644348-03 | MYY | .975117-04  |
|     | NUDE 125 | MXX | .179387-03 | MYY | .646775-03 | MXY | .328833-04  |
|     | NUDE 26  | MXX | .351079-03 | MYY | .104894-03 | MXY | .651974-04  |
|     | NUDE 126 | MXX | .244357-03 | MYY | .769394-03 | MXY |             |
| 141 | CENTROID | SXX | -145171-01 | STY | -194025-01 | SXY | -252061-01  |
|     | VXX      | MXX | .439023-04 | VYY | .107079-03 | MYY | .173014-04  |
|     | NUDE 27  | MXX | .982853-04 | MYY | .251284-03 | MXY | .123631-03  |
|     | NUDE 128 | MXX | .553680-04 | MYY | .504924-03 | MXY | .531617-04  |
|     | NUDE 127 | MXX | .148742-04 | MYY | .416683-04 | MXY |             |
| 142 | CENTROID | SXX | .968621-02 | STY | .236151-01 | SXY | .23/872-01  |
|     | VXX      | MXX | .313895-03 | VYY | .153953-03 | MYY | .102846-04  |
|     | NUDE 129 | MXX | .391394-03 | MYY | .567701-03 | MXY | .45227-04   |
|     | NUDE 27  | MXX | .264681-03 | MYY | .420261-03 | MXY | .115945-06  |
|     | NUDE 28  | MXX | .315151-03 | MYY | .166086-03 | MXY |             |
| 143 | CENTROID | SXX | .308057-02 | STY | .251939-01 | SXY | .224637-01  |
|     | VXX      | MXX | .684866-05 | VYY | .165554-04 | MYY | .373696-04  |
|     | NUDE 29  | MXX | .465935-04 | MYY | .156205-04 | MXY | .83035-04   |
|     | NUDE 130 | MXX | .151510-04 | MYY | .608446-04 | MXY | .602030-04  |
|     | NUDE 129 | MXX | .273599-04 | MYY | .875808-05 | MXY |             |
| 144 | CENTROID | SXX | .590612-01 | STY | .050612-02 | SXY | .402956-01  |
|     | VXX      | MXX | .252038-03 | VYY | .161411-03 | MYY | .40103-04   |
|     | NUDE 130 | MXX | .182940-03 | MYY | .269768-03 | MXY | .497109-04  |
|     | NUDE 29  | MXX | .361274-03 | MYY | .302499-03 | MXY | .252880-04  |
|     | NUDE 30  | MXX | .320068-03 | MYY | .660113-04 | MXY |             |
| 145 | CENTROID | SXX | .296662-01 | STY | .119462-02 | SXY | .405476-02  |
|     | VXX      | MXX | .909365-04 | VYY | .166800-03 | MYY | .140291-03  |
|     | NUDE 31  | MXX | .110361-03 | MYY | .744075-04 | MXY | .401035-04  |
|     | NUDE 230 | MXX | .238517-03 | MYY | .288111-03 | MXY | .772412-04  |
|     | NUDE 30  | MXX | .190292-03 | MYY | .150363-04 | MXY |             |
| 146 | CENTROID | SXX | .203084-02 | STY | .231749-01 | SXY | .160542-01  |
|     | VXX      | MXX | .116037-03 | VYY | .499779-03 | MYY | .246362-03  |
|     | NUDE 130 | MXX | .111009-03 | MYY | .237641-03 | MXY | .209111-03  |
|     | NUDE 31  | MXX | .353532-03 | MYY | .236520-03 | MXY | .227757-03  |
|     | NUDE 131 | MXX | .158346-03 | MYY | .521345-03 | MXY |             |
| 147 | CENTROID | SXX | .114302-02 | STY | .213360-01 | SXY | .6480000-02 |
|     | VXX      | MXX | .319503-04 | VYY | .105553-03 | MYY | .235464-03  |
|     | NUDE 32  | MXX | .165512-03 | MYY | .169587-03 | MXY | .211377-03  |
|     | NUDE 133 | MXX | .424329-04 | MYY | .674021-04 | MXY | .223431-03  |
|     | NUDE 32  | MXX | .241569-04 | MYY | .373398-04 | MXY |             |
| 148 | CEN1K00  | SXX | .652515-01 | STY | .251674-01 | SXY | .111597-01  |





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